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September 1978

U.S. Environmental Protection Agency

South Bay Dischargers Authority

EPA-9-CA-South Bay Dischargers Authority - 78

DRAFT
ENVIRONMENTAL IMPACT REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

SOUTH BAY DISCHARGERS AUTHORITY
TREATED WASTEWATER DISPOSAL PROGRAM

November, 1978

Prepared by:
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

and
South Bay Dischargers Authority
801 North First Street
San Jose, California 95110

With technical assistance from:
Bechtel Inc.
50 Beale Street
San Francisco, California 94119

In association with:
E. H. Smith and Associates
Archaeological Consulting and Research Services, Inc.
Mr. Michael Melanson
R. C. Harlan and Associates
Pacific Environmental Laboratory
Hydroscience, Inc.

Grant No. CA-06-1135

RESPONSIBLE OFFICIALS:

Frank M. Covington
for Paul De Falco, Jr.
Regional Administrator
Environmental Protection Agency
Region IX

Franklin D. Knofler
Franklin D. Knofler
Acting Chief Executive Officer
South Bay Dischargers Authority

NOV 29 1978

To All Interested Agencies, Public Groups, and Concerned Individuals:

The Draft Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) for the South Bay Dischargers Authority Treated Wastewater Disposal Program is complete and is being distributed at this time for your review and comment. This program would provide a wastewater disposal system for the San Jose/Santa Clara, Sunnyvale, and Palo Alto wastewater treatment plants, located in the Santa Clara County Baylands along the southeastern edge of San Francisco Bay. The Draft EIR/EIS has been prepared to conform with the requirements of the National Environmental Policy Act of 1969 and the California Environmental Quality Act of 1970, as amended.

The project alternative has not been selected. However, the Environmental Protection Agency (EPA) and the South Bay Dischargers Authority (SBDA), at this time, recommend a "no project alternative" for the following reasons:

1. The degree to which increased dilution resulting from a discharge north of the Dumbarton Bridge will mitigate the adverse impacts of toxicants on the biota of the South Bay cannot be predicted.
2. Modeling studies have not shown that a substantial improvement in dissolved oxygen concentrations would result if the discharges were moved north of the Dumbarton Bridge.
3. The viability of future full reclamation is being investigated in the Regional Wastewater Reclamation Study. Should such an alternative prove to be feasible, it would meet the planning requirements of the San Francisco Bay Basin Plan.

The EPA and the SBDA recognize that comprehensive receiving water monitoring will be needed to document the impacts of wastewater discharges in the South Bay after treatment facilities, now under construction, are placed in full operation. In addition, each discharging agency is committed to local and regional wastewater reclamation investigations.

This decision is being recommended by EPA and SBDA, based upon present knowledge. However, if the final selection is a "no project alternative," we will continue to evaluate results of the monitoring program and will reconsider our selection, if appropriate.

The Final EIR/EIS will identify the project alternative selected after consideration of the public comments.

Comments on the Draft EIR/EIS should be sent to this office within 45 days of the date of this letter. All comments received will be considered in preparation of the Final EIR/EIS for this action. If you fail to comment within the specified time, it shall be assumed, absent a request for a specific extension of time, that you have no comment to make.

In order to receive testimony from the public, EPA will hold a public hearing on the Draft. It is presently anticipated that the hearing will be held in January or early February 1979. Public notice will be given in the local newspapers at least thirty days in advance of the public hearing.

The hearing may be continued from time to time, or to a different place, after its commencement, to accommodate the need of witnesses or the EPA.

All interested parties are invited to express their views at this hearing. Persons wishing to make comments may submit them in writing and/or appear at the hearing. Written comments should be submitted in triplicate to:

U.S. Environmental Protection Agency
Region IX
Attn: Hearing Office (HE-141)
215 Fremont Street
San Francisco, CA 94105

Oral statements will be received and considered, but, for accuracy of the record, all important testimony should be submitted in writing. Oral statements should summarize extensive written materials so that there will be time for all interested persons to be heard. Enough copies of the written materials should be produced so that other interested persons may receive a copy and there will be no necessity for written materials to be read at length.

The following documents constitute the Draft EIR/EIS:

Summary
Main Text
Appendices (2 volumes)

The Draft may be reviewed at the following locations:

U.S. Environmental Protection Agency
Region IX
Library
215 Fremont Street
San Francisco, CA 94105

U.S. Environmental Protection Agency
Public Reference Unit (P.M. 213)
401 M Street, S.W., Room 2922
Washington, D.C. 20460

Documents Librarian
Santa Clara County Library
Research Center
10400 Torre Avenue
Cupertino, CA 95014

San Jose Public Library
180 W. San Carlos St.
San Jose, CA 95110

Palo Alto Public Library
1213 Newell Rd.
Palo Alto, CA 94303

Santa Clara County Library
7387 Rosanna St.
Gilroy, CA 95020

Santa Clara County Library
78 South Dempsey Rd
Milpitas, CA 95035

Mountain View Public Library
585 Franklin Street
Mountain View, CA 94040

Library
Water Resources Center
University of California
Berkeley, CA 94720

Santa Clara Public Library
2635 Homestead Road
Santa Clara, CA 95051

Sunnyvale Public Library
Attn: Documents Librarian
665 W. Olive Avenue
Sunnyvale, CA 94086

Santa Clara County Library
1095 North 7th Street
San Jose, CA 95112

NASA Ames Research Center
Technical Library
Moffett Field
Sunnyvale, CA 94040

City of San Jose
Planning Department
801 North First Street
San Jose, California 95110

City of Santa Clara
Planning Department
1500 Warburton Avenue
Santa Clara, CA 95050

City of Mountain View
Planning Department
540 Castro Street
Mountain View, CA 94040

City of Sunnyvale
Planning Department
P.O Box 607
456 W. Olive Avenue
Sunnyvale, CA 94088

City of Los Altos
Planning Department
1 N. San Antonio Road
Los Altos, CA. 94022

City of Palo Alto
Planning Department
250 Hamilton Street
Palo Alto, CA 94301

City of Milpitas
Planning Department
455 E. Calaveras Blvd.
Milpitas, CA 95035

City of Cupertino
Planning Department
City Hall, 10300 Torre Ave
Cupertino, CA 95014

Town of Los Altos Hills
Planning Department
26379 Fremont Road
Los Altos Hills, CA 94022

City of Los Gatos
Planning Department
P.O. Box 949
Los Gatos, CA 95030

City of Monte Sereno
Planning Department
18041 Saratoga-Los Gatos Road
Monte Sereno, CA 95030

Please bring this notice to the attention of all persons who would be interested in this matter.

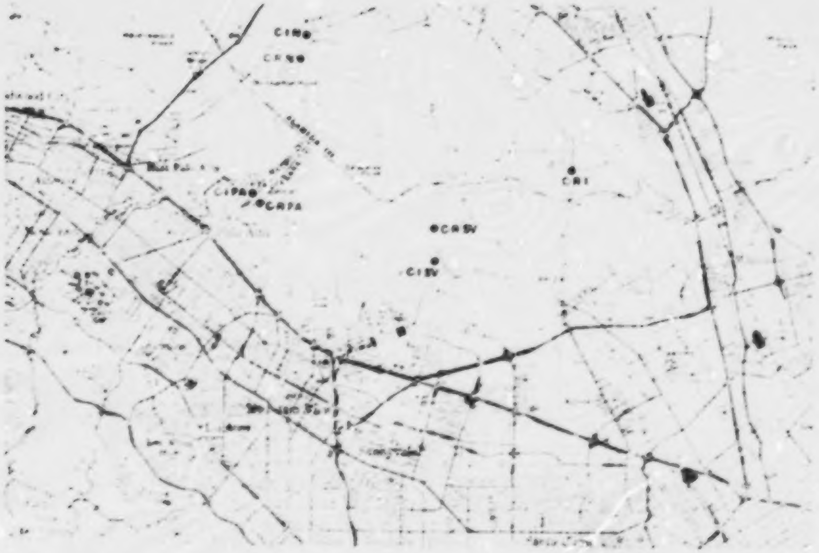
U.S. Environmental Protection Agency, Region IX
for Frank M Covington
by Paul De Falco, Jr.
Regional Administrator

South Bay Dischargers Authority
Franklin D. Knofler
by Franklin D. Knofler
Acting Chief Executive Officer

Appendix D

SAN FRANCISCO BAY RECEIVING WATER QUALITY DATA FOR SAN MATEO, SUNNYVALE, AND UNION SANITARY DISTRICTS

From the files of Regional Water Quality Control Board Oakland


C1N
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C1PA
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CR1
CRSV
C1SV

Figure D-1
APPROXIMATE SAMPLING LOCATIONS
FOR NPDES MONITORING

I. SAN MATEO

Yearly summary for 1974 - 1977

Location Key:

C-1 Geometric center of outfall diffuser, 240 feet north of San Mateo Bridge centerline, 3700 feet from shore.

C-R 2000 feet up current from -1 in midchannel.

ANNUAL RECEIVING WATER DATA
SUMMARY

San Mateo 1974

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			10.2			9.4	1
FEBRUARY			10.8			9.2	1
MARCH			8.0			7.0	1
APRIL			7.2			8.8	1
MAY			7.4			8.2	1
JUNE			6.4			6.4	1
JULY			7.0			7.2	1
AUGUST			6.6			6.2	1
SEPTEMBER			6.8			6.4	1
OCTOBER			8.4			9.2	1
NOVEMBER			8.9			7.4	1
DECEMBER			6.8			5.7	1
ANNUAL MAXIMUM	10.8			9.4			Total No of Samples
ANNUAL MINIMUM		6.4			5.7		12
ANNUAL AVERAGE			7.9			7.6	

FOOTNOTE. C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

San Mateo 1974

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			8.10			8.18	1
FEBRUARY			7.60			7.80	1
MARCH			8.27			8.15	1
APRIL			8.38			8.12	1
MAY			8.14			8.09	1
JUNE			8.08			8.02	1
JULY			8.07			8.06	1
AUGUST			8.07			7.89	1
SEPTEMBER			8.10			7.90	1
OCTOBER			8.59			8.50	1
NOVEMBER			7.95			7.92	1
DECEMBER			7.90			7.80	1
ANNUAL MAXIMUM	8.59			8.50			Total No of Samples
ANNUAL MINIMUM		7.60			7.80		12
ANNUAL AVERAGE			8.10			8.09	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

San Mateo 1975

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			5.6			6.0	1
FEBRUARY			6.6			7.5	1
MARCH			7.3			6.9	1
APRIL			5.7			5.6	1
MAY			9.0			6.2	1
JUNE			6.5			6.0	1
JULY			8.0			7.8	1
AUGUST			7.7			8.0	1
SEPTEMBER			6.7			7.1	1
OCTOBER			7.0			6.8	1
NOVEMBER			7.4			7.2	1
DECEMBER			8.2			10.8	1
ANNUAL MAXIMUM	9.0			10.8			TOTAL NUMBER OF SAMPLES
ANNUAL MINIMUM		6.5			5.6		12
ANNUAL AVERAGE			7.1			7.2	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

San Mateo 1975

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.54			7.64	1
FEBRUARY			7.93			7.90	1
MARCH			8.09			8.07	1
APRIL			8.15			8.12	1
MAY			8.40			6.76	1
JUNE			7.58			7.56	1
JULY			8.07			7.70	1
AUGUST			8.07			7.97	1
SEPTEMBER			7.96			8.05	1
OCTOBER			7.76			7.69	1
NOVEMBER			7.84			7.71	1
DECEMBER			7.60			7.95	1
ANNUAL MAXIMUM	8.40			8.12			Total No of Samples
ANNUAL MINIMUM		7.54			6.76		12
ANNUAL AVERAGE			7.92			7.74	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

San Mateo 1976

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			10.2			10.6	1
FEBRUARY			NA			NA	0
MARCH			9.8			9.9	1
APRIL			NA			NA	0
MAY			8.0			8.0	1
JUNE			7.4			7.2	1
JULY			NA			NA	0
AUGUST			6.4			6.1	1
SEPTEMBER			NA			NA	0
OCTOBER			6.3			6.3	1
NOVEMBER			NA			NA	0
DECEMBER			7.8			7.7	1
ANNUAL MAXIMUM	10.2			10.6			TOTAL No OF SAMPLES
ANNUAL MINIMUM		6.3			6.1		7
ANNUAL AVERAGE			8.0			8.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

San Mateo 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.5			7.6	1
FEBRUARY			NA			NA	0
MARCH			7.6			7.5	1
APRIL			NA			NA	0
MAY			7.4			6.9	1
JUNE			7.4			7.2	1
JULY			NA			NA	0
AUGUST			8.3			8.0	1
SEPTEMBER			8.1			8.0	1
OCTOBER			8.0			7.9	1
NOVEMBER			NA			NA	0
DECEMBER			7.8			7.7	1
ANNUAL MAXIMUM	8.3			8.0			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.4			6.9		8
ANNUAL AVERAGE			7.8			7.6	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

San Mateo 1977

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			NA			NA	0
FEBRUARY			9.0			9.0	1
MARCH			9.0			8.9	1
APRIL			NA			NA	0
MAY			NA			NA	0
JUNE			8.1			7.9	1
JULY			NA			NA	0
AUGUST			NA			NA	0
SEPTEMBER			NA			NA	0
OCTOBER			8.1			7.8	1
NOVEMBER			NA			NA	0
DECEMBER			8.8			9.0	1
ANNUAL MAXIMUM	9.0			9.0			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		8.1			7.8		5
ANNUAL AVERAGE			8.6			8.5	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

2. PALO ALTO

Yearly summary for 1975 - 1977

Location Key:

C-1 In discharge canal at discharge point

C-R On Mayfield Slough near confluence with Charleston Slough

ANNUAL RECEIVING WATER DATA SUMMARY

San Mateo 1977

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			NA			NA	0
FEBRUARY			7.8			7.8	1
MARCH			8.2			7.9	1
APRIL			NA			NA	0
MAY			NA			NA	0
JUNE			8.0			7.9	1
JULY			NA			NA	0
AUGUST			NA			NA	0
SEPTEMBER			NA			NA	0
OCTOBER			7.9			7.9	1
NOVEMBER			NA			NA	0
DECEMBER			7.8			7.7	2
ANNUAL MAXIMUM	8.2			7.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.8			7.7		6
ANNUAL AVERAGE			7.9			7.8	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1975

PARAMETER / MONTH	Dissolved Oxygen MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY							
FEBRUARY							
MARCH			6.9			7.2	2
APRIL			9.0			5.8	2
MAY			7.2			7.2	2
JUNE			7.0			7.2	2
JULY			5.0			5.2	1
AUGUST			5.2			5.6	1
SEPTEMBER			5.3			4.3	2
OCTOBER			7.3			6.2	2
NOVEMBER							
DECEMBER							
ANNUAL MAXIMUM							
ANNUAL MINIMUM							
ANNUAL AVERAGE							

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1975

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY							
FEBRUARY							
MARCH			7.8			7.2	2
APRIL			8.3			7.1	2
MAY			7.4			7.1	2
JUNE			7.7			7.0	2
JULY							
AUGUST			8.3			7.3	1
SEPTEMBER			7.6			7.0	2
OCTOBER			7.9			7.1	2
NOVEMBER							
DECEMBER							
ANNUAL MAXIMUM							
ANNUAL MINIMUM							
ANNUAL AVERAGE							

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1976

PARAMETER / MONTH	Dissolved Oxygen MG/L						
	STATION C-R			STATION C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	–	–	7.0	–	–	6.4	2
FEBRUARY	–	–	8.0	–	–	7.8	2
MARCH	–	–	8.6	–	–	6.8	2
APRIL	7.0	5.1	6.4	6.1	5.9	6.0	2
MAY	5.7	5.4	5.6	6.9	5.8	6.1	2
JUNE	5.4	5.1	5.3	5.9	5.4	5.7	2
JULY	5.1	5.1	5.1	5.9	5.9	5.9	1
AUGUST	5.2	5.1	5.2	6.6	6.4	6.5	2
SEPTEMBER	6.0	5.1	5.5	6.6	5.9	6.3	2
OCTOBER	7.0	5.1	6.0	5.2	5.1	5.2	2
NOVEMBER	8.6	6.4	7.5	7.4	5.0	6.2	2
DECEMBER	7.5	7.0	7.3	6.7	6.3	6.5	2
ANNUAL MAXIMUM	6.4			6.4			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		6.5			5.7		23
ANNUAL AVERAGE			6.5			6.3	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	–	–	7.6	–	–	7.0	2
FEBRUARY	–	–	8.0	–	–	7.1	2
MARCH	–	–	7.2	–	–	6.8	2
APRIL	7.7	7.6	7.7	7.2	7.1	7.1	2
MAY	7.8	7.6	7.7	7.5	7.0	7.2	2
JUNE	7.8	7.7	7.8	7.3	6.8	7.3	2
JULY	7.6	7.6	7.6	7.1	7.1	7.1	1
AUGUST	7.6	7.5	7.6	7.1	7.0	7.1	2
SEPTEMBER	7.3	7.3	7.3	6.8	6.8	6.8	2
OCTOBER	7.5	6.9	7.2	6.9	6.5	6.7	2
NOVEMBER	7.7	6.9	7.3	6.9	6.9	6.9	2
DECEMBER	7.5	7.3	7.4	7.0	6.9	7.0	2
ANNUAL MAXIMUM	7.6			7.0			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.4			6.9		23
ANNUAL AVERAGE			7.5			7.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1977

PARAMETER / MONTH	Dissolved Oxygen MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.5	8.4	8.5	7.7	6.5	7.1	2
FEBRUARY	9.1	9.0	9.1	7.5	7.0	7.3	2
MARCH	8.9	8.2	8.6	7.5	7.5	7.5	2
APRIL	6.6	6.4	6.5	6.9	6.5	6.7	2
MAY	6.3	5.7	6.0	6.9	6.6	6.8	2
JUNE	4.4	4.1	4.3	4.0	3.6	3.8	2
JULY	4.1	3.9	4.0	4.1	3.4	3.8	2
AUGUST	5.8	5.4	5.6	6.9	5.5	6.0	2
SEPTEMBER	6.8	4.4	5.6	4.7	3.6	4.2	2
OCTOBER	5.3	4.1	4.7	7.2	4.0	5.6	2
NOVEMBER	6.6	6.2	6.4	6.5	6.2	6.4	2
DECEMBER	7.3	5.5	6.4	7.0	6.1	6.6	2
ANNUAL MAXIMUM	6.6			6.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		5.9			5.5		24
ANNUAL AVERAGE			6.3			6.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Palo Alto 1977

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.6			7.1	2
FEBRUARY			7.9			7.0	2
MARCH			8.2			7.5	2
APRIL			7.9			7.1	2
MAY			7.8			7.2	2
JUNE			7.8			7.5	2
JULY			7.8			7.6	2
AUGUST			7.8			7.2	2
SEPTEMBER			7.9			7.5	2
OCTOBER			7.5			7.2	2
NOVEMBER			7.8			7.[illegible]	2
DECEMBER			7.6			7.2	2
ANNUAL MAXIMUM	8.2			7.6			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.5			7.0		24
ANNUAL AVERAGE			7.8			7.3	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

1. SUNNYVALE

Yearly summary for 1972 1977

Location Key:

C-1 Guadalupe Slough, near U.S.N.A.S Moffett Field Fuel Dock, approximately 1000 ft. downstream from outfall

C-R Guadalupe Slough, at PG&E power line crossing, approximately 2000 feet from the mouth of the slough.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.4	6.8	7.6	7.4	7.0	7.25	6
FEBRUARY	7.1	7.0	7.05	6.9	5.5	6.18	6
MARCH	5.0	2.4	3.7	4.6	3.6	4.08	6
APRIL	6.6	5.2	5.9	6.0	4.5	5.4	6
MAY	3.9	3.8	3.85	7.0	2.0	4.33	6
JUNE	3.6	2.5	3.05	3.5	1.5	2.35	6
JULY	4.7	3.2	4.0	9.0	2.1	4.58	6
AUGUST	4.5	3.1	3.8	4.4	1.5	3.05	6
SEPTEMBER	3.7	1.6	2.65	3.7	1.3	2.3	6
OCTOBER	4.8	3.2	4.0	3.5	2.4	2.8	6
NOVEMBER	6.2	5.7	5.95	5.4	5.0	5.25	6
DECEMBER	7.8	6.7	7.25	7.5	5.2	6.55	6
ANNUAL MAXIMUM	5.5			5.7			Total No of Samples
ANNUAL MINIMUM		4.3			3.5		72
ANNUAL AVERAGE			4.9			4.51	

FOOTNOTE C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.2	7.75	7.98	8.2	7.8	7.96	6
FEBRUARY	7.75	7.5	7.63	7.75	7.5	7.58	6
MARCH	7.70	7.4	7.55	7.7	7.7	7.7	6
APRIL	8.0	7.9	7.95	8.0	7.6	7.83	6
MAY	7.4	7.4	7.4	7.8	7.2	7.55	6
JUNE	7.6	7.4	7.5	7.7	7.5	7.6	6
JULY	7.6	7.5	7.55	7.9	7.5	7.65	6
AUGUST	7.6	7.5	7.55	7.6	7.5	7.55	6
SEPTEMBER	7.5	7.2	7.35	7.6	7.6	7.6	6
OCTOBER	7.3	7.3	7.3	7.2	7.0	7.1	6
NOVEMBER	7.4	7.3	7.35	7.5	7.3	7.4	6
DECEMBER	7.3	7.3	7.3	7.4	7.3	7.35	4
ANNUAL MAXIMUM	7.6			7.7			Total No. of Samples
ANNUAL MINIMUM		7.45			7.46		70
ANNUAL AVERAGE			7.53			7.57	

FOOTNOTE: C R – REFERENCE STATION

C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	°C						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.0	6.5	7.25	8.0	6.0	7.1	6
FEBRUARY	14.0	14.0	14.0	14.5	14.0	14.3	6
MARCH	17.2	14.0	15.6	17.5	13.2	15.4	6
APRIL	17.0	16.0	16.5	17.0	15.8	16.4	6
MAY	19.0	17.5	18.25	20.0	17.8	18.7	6
JUNE	22.5	20.5	21.5	23.0	21.2	22.1	6
JULY	24.5	19.5	22.0	24.5	20.0	22.4	6
AUGUST	23.5	21.0	22.25	23.0	21.0	21.8	6
SEPTEMBER	19.0	18.0	18.5	19.5	18.0	18.6	6
OCTOBER	17.0	17.0	17.0	17.3	16.8	17.1	6
NOVEMBER	15.0	12.0	13.5	15.0	11.4	13.3	6
DECEMBER	9.0	4.5	6.75	10.0	4.0	6.9	6
ANNUAL MAXIMUM	17.1			17.3			Total No. of Samples
ANNUAL MINIMUM		15.0			14.9		72
ANNUAL AVERAGE			16.1			16.2	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	BOD5						
	Concentration (mg/l)			Loading (lbs/day)			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	62	50	56	6557	5288	5949	4
FEBRUARY	79	57	68	6536	4706	5622	5
MARCH	98	24	49	9154	2242	4597	4
APRIL	39	18	29	3139	1449	2314	4
MAY	32	16	23	3443	1721	2474	5
JUNE	21	11	17	1874	982	1473	4
JULY	35	19	27	3741	2028	2830	4
AUGUST	82	42	63	10737	5499	8197	5
SEPTEMBER	63	46	57	7986	5831	7162	4
OCTOBER	42	30	37	6060	4329	5375	4
NOVEMBER	53	8	25	6896	1041	3200	5
DECEMBER	36	20	29	5104	2836	4147	4
ANNUAL MAXIMUM	54			5936			Total No. of Samples
ANNUAL MINIMUM		28			3163		52
ANNUAL AVERAGE			40			4443	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	Ammonia Nitrogen Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			1.25			1.20	2
FEBRUARY			0.27			0.20	2
MARCH			3.08			5.63	2
APRIL			2.98			5.78	2
MAY			1.48			3.25	2
JUNE			0.60			0.77	2
JULY			1.14			1.49	2
AUGUST			0.13			0.70	2
SEPTEMBER			0.13			0.43	2
OCTOBER			0.01			0.20	2
NOVEMBER			0.40			0.46	2
DECEMBER			1.22			1.89	2
ANNUAL MAXIMUM							Total No. of Samples
ANNUAL MINIMUM							24
ANNUAL AVERAGE			1.06			1.83	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	Nitrate Nitrogen Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			1.75			1.60	2
FEBRUARY			2.50			2.10	2
MARCH			1.74			1.40	2
APRIL			3.50			2.15	2
MAY			2.50			2.45	2
JUNE			2.10			1.73	2
JULY			1.50			1.85	2
AUGUST			1.05			0.55	2
SEPTEMBER			1.00			0.53	2
OCTOBER			0.96			1.10	2
NOVEMBER			1.26			1.46	2
DECEMBER			1.48			1.30	2
ANNUAL MAXIMUM							Total No. of Samples
ANNUAL MINIMUM							24
ANNUAL AVERAGE			1.78			1.52	

FOOTNOTE: C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	Total Organic Nitrogen Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			2.45			2.39	2
FEBRUARY			1.27			1.84	2
MARCH			4.03			2.02	2
APRIL			4.03			2.01	2
MAY			5.01			5.82	2
JUNE			2.11			2.68	2
JULY			2.72			3.43	2
AUGUST			1.72			2.51	2
SEPTEMBER			1.96			2.86	2
OCTOBER			2.30			2.10	2
NOVEMBER			1.02			2.42	2
DECEMBER			1.00			2.40	2
ANNUAL MAXIMUM							Total No of Samples
ANNUAL MINIMUM							24
ANNUAL AVERAGE			2.47			2.71	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1972

PARAMETER / MONTH	Phosphate Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			0.92			1.24	2
FEBRUARY			1.00			1.60	2
MARCH			2.07			2.18	2
APRIL			1.52			2.00	2
MAY			2.72			3.36	2
JUNE			1.80			2.40	2
JULY			2.44			3.40	2
AUGUST			2.80			3.96	2
SEPTEMBER			2.12			3.04	2
OCTOBER			1.48			2.20	2
NOVEMBER			1.28			1.60	2
DECEMBER			2.00			2.40	2
ANNUAL MAXIMUM							Total No. of Samples
ANNUAL MINIMUM							24
ANNUAL AVERAGE			1.85			2.45	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1973

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	9.0	8.7	8.9	8.4	8.0	8.3	6
FEBRUARY	9.0	9.0	9.0	9.2	9.0	9.1	6
MARCH	7.8	7.0	7.4	8.1	7.1	7.6	6
APRIL	9.8	4.6	7.2	9.4	5.8	7.9	6
MAY	5.5	4.0	4.8	5.6	3.0	4.3	6
JUNE	7.2	3.1	5.2	7.8	2.2	4.7	6
JULY	4.4	3.7	4.1	4.4	4.0	4.2	6
AUGUST	5.7	4.7	5.2	5.5	3.6	4.6	6
SEPTEMBER	3.0	2.8	2.9	2.5	1.1	1.9	6
OCTOBER	3.3	3.0	3.2	3.4	1.4	2.6	6
NOVEMBER	9.4	6.3	7.9	8.5	6.0	7.3	6
DECEMBER	8.1	7.0	7.6	7.9	5.7	6.8	6
ANNUAL MAXIMUM	9.8			9.4			Total No. of Samples
ANNUAL MINIMUM		2.8			1.1		72
ANNUAL AVERAGE			6.1			5.8	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1973

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.8	7.6	7.7	7.8	7.5	7.6	6
FEBRUARY	7.9	7.7	7.8	7.9	7.8	7.9	6
MARCH	7.7	7.6	7.65	7.9	7.7	7.8	6
APRIL	7.8	7.4	7.6	7.8	7.6	7.7	6
MAY	7.9	7.5	7.7	8.0	7.5	7.7	6
JUNE	7.7	7.5	7.6	7.8	7.3	7.6	6
JULY	7.7	7.4	7.55	7.8	7.3	7.5	6
AUGUST	7.6	7.5	7.55	7.7	7.5	7.6	6
SEPTEMBER	7.3	7.3	7.3	7.4	7.2	7.3	6
OCTOBER	7.3	7.2	7.25	7.4	6.8	7.2	6
NOVEMBER	7.5	7.5	7.5	7.5	7.4	7.45	6
DECEMBER	7.7	7.6	7.65	7.4	7.4	7.4	6
ANNUAL MAXIMUM	7.9			8.0			Total No. of Samples
ANNUAL MINIMUM		7.2			6.8		72
ANNUAL AVERAGE			7.6			7.6	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1973

PARAMETER / MONTH	°C						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	11	9	10	11	9	10	6
FEBRUARY	14	12	13	13	12	12.5	6
MARCH	13.8	12	12.9	13.8	12	12.9	6
APRIL	18.5	16	17.3	19.5	16	17.6	6
MAY	22	19	20.5	21	19	19.9	6
JUNE	24	23	23.5	25	24	24.5	6
JULY	21	20	20.5	21	20	20.8	6
AUGUST	22	18	20	23	19	21	6
SEPTEMBER	21	19	20	21	20	20.5	6
OCTOBER	16.5	16	16.3	17	16	16.4	6
NOVEMBER	16	10	13	16	10	13	6
DECEMBER	11	10	10.5	11	10	10.5	6
ANNUAL MAXIMUM	24			25			Total No. of Samples
ANNUAL MINIMUM		9			9		72
ANNUAL AVERAGE			16.5			16.6	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1973

PARAMETER	Ammonia Nitrogen Mg/l						
	Station C-R			Station C-1			
MONTH	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY	0.54			1.18			2
FEBRUARY	1.09			0.57			2
MARCH	3.92			4.18			2
APRIL	2.21			4.83			2
MAY	0.46			0.83			2
JUNE	4.20			5.20			2
JULY	1.50			3.10			2
AUGUST	0.10			2.22			2
SEPTEMBER	2.55			2.04			2
OCTOBER	1.50			4.66			2
NOVEMBER	2.93			4.61			2
DECEMBER	1.50			1.78			2
ANNUAL MAXIMUM	4.20			5.20			Total No. of Samples
ANNUAL MINIMUM		0.10			0.57		24
ANNUAL AVERAGE			1.87			2.93	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1973

PARAMETER	Nitrate Nitrogen Mg/l						
	Station C-R			Station C-1			
MONTH	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY	0.70			1.02			2
FEBRUARY	1.0			1.54			2
MARCH	1.36			1.30			2
APRIL	0.50			0.60			2
MAY	0.32			0.27			2
JUNE	0.37			0.46			2
JULY	0.49			0.58			2
AUGUST	0.70			0.57			2
SEPTEMBER	0.60			0.30			2
OCTOBER	0.74			0.56			2
NOVEMBER	0.66			0.50			2
DECEMBER	0.76			0.78			2
ANNUAL MAXIMUM	1.36			1.54			Total No of Samples
ANNUAL MINIMUM		0.32			0.27		24
ANNUAL AVERAGE			0.68			0.71	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1973

PARAMETER / MONTH	Organic Nitrogen Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	1.52			1.02			2
FEBRUARY	0.04			0.09			2
MARCH	0.95			1.53			2
APRIL	3.31			3.13			2
MAY	3.62			4.32			2
JUNE	3.5			3.6			2
JULY	5.10			5.7			2
AUGUST	4.15			4.13			2
SEPTEMBER	1.10			2.63			2
OCTOBER	3.62			3.97			2
NOVEMBER	0.41			2.23			2
DECEMBER	0.61			2.79			2
ANNUAL MAXIMUM	5.10			5.70			Total No. of Samples
ANNUAL MINIMUM		0.04			0.09		24
ANNUAL AVERAGE			2.33			2.76	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1973

PARAMETER / MONTH	Phosphate Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	0.4			0.4			2
FEBRUARY	1.12			0.72			2
MARCH	2.4			2.8			2
APRIL	1.2			1.6			2
MAY	2.64			3.08			2
JUNE	3.3			3.2			2
JULY	3.0			3.6			2
AUGUST	2.4			3.4			2
SEPTEMBER	2.8			3.6			2
OCTOBER	2.0			2.4			2
NOVEMBER	1.0			1.2			2
DECEMBER	0.8			1.2			2
ANNUAL MAXIMUM	3.3			3.6			Total No. of Samples
ANNUAL MINIMUM		0.4			0.4		24
ANNUAL AVERAGE			1.92			2.27	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.5	7.1	7.8	8.3	6.8	7.5	6
FEBRUARY	6.8	6.8	6.8	6.0	5.6	5.8	3
MARCH	9.6	7.4	8.5	9.0	6.8	7.9	6
APRIL	6.8	6.6	6.7	8.5	6.1	7.3	6
MAY	7.7	2.6	5.1	6.9	1.5	4.1	6
JUNE	5.4	4.2	4.8	3.8	2.4	2.8	6
JULY	5.4	4.4	4.9	5.0	2.2	3.5	6
AUGUST	5.0	4.2	4.6	5.8	2.6	4.0	6
SEPTEMBER	2.4	2.4	2.4	3.2	1.6	2.3	6
OCTOBER	4.4	4.0	4.2	4.2	1.9	2.8	6
NOVEMBER	5.8	4.4	5.1	5.1	3.4	4.0	6
DECEMBER	6.8	5.2	6.0	6.3	5.0	5.6	6
ANNUAL MAXIMUM	9.6			9.0			Total No. of Samples
ANNUAL MINIMUM		2.4			1.5		69
ANNUAL AVERAGE			5.6				

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.7	7.5	7.6	7.6	7.5	7.5	6
FEBRUARY	7.8	7.8	7.8	7.7	7.6	7.6	3
MARCH	7.7	7.6	7.6	7.8	7.5	7.6	6
APRIL	7.7	7.6	7.6	7.9	7.5	7.7	6
MAY	7.7	7.5	7.6	7.7	7.3	7.5	6
JUNE	7.8	7.8	7.8	7.8	7.5	7.6	6
JULY	7.6	7.4	7.5	7.7	7.0	7.4	6
AUGUST	7.9	7.6	7.7	7.9	6.7	7.2	6
SEPTEMBER	7.5	7.4	7.4	7.6	7.4	7.5	6
OCTOBER	8.1	8.0	8.0	8.2	7.7	7.9	6
NOVEMBER	7.7	7.7	7.7	7.8	7.6	7.6	6
DECEMBER	7.9	7.8	7.8	7.9	7.5	7.7	6
ANNUAL MAXIMUM	8.1			8.2			Total No of Samples
ANNUAL MINIMUM		7.4			6.7		69
ANNUAL AVERAGE			7.7				

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	°C						
							NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	12	11	11.5	11	11	11	6
FEBRUARY	12	12	12	12	12	12	3
MARCH	15	10	12.5	15	10	12.5	6
APRIL	18.5	18	18.2	19	18	18.5	6
MAY	21	18	19.5	21	18	19.5	6
JUNE	19	18	18.5	20	19.5	19.7	6
JULY	22	20.5	21.2	23	20.5	21.6	6
AUGUST	21	20	20.5	22	20.5	21.1	6
SEPTEMBER	21	19.5	20.2	21	20	20.5	6
OCTOBER	20	18	19	20.5	17.5	19	6
NOVEMBER	15	14	14.5	14.5	13.5	14.1	6
DECEMBER	13	10.5	11.7	13	9.5	11.5	6
ANNUAL MAXIMUM	22			23			Total No. of Samples
ANNUAL MINIMUM		10			9.5		69
ANNUAL AVERAGE			16.6			16.7	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	Ammonia Nitrogen Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	2.03			5.04			2
FEBRUARY	2.39			6.01			2
MARCH	1.13			3.82			2
APRIL	2.99			5.51			2
MAY	1.26			5.14			2
JUNE	1.55			2.72			2
JULY	1.79			2.49			2
AUGUST	0.51			0.21			2
SEPTEMBER	0.01			3.02			2
OCTOBER	1.36			6.92			2
NOVEMBER	6.12			7.94			2
DECEMBER	6.4			9.30			2
ANNUAL MAXIMUM	6.40			9.30			Total No. of Samples
ANNUAL MINIMUM		0.01			0.21		24
ANNUAL AVERAGE			2.30			4.80	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	Nitrate Nitrogen Mg/l						NUMBER OF SAMPLES
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	0.83			0.73			2
FEBRUARY	0.93			0.98			2
MARCH	0.72			0.50			2
APRIL	0.75			0.79			2
MAY	0.98			1.27			2
JUNE	1.30			0.95			2
JULY	1.48			1.46			2
AUGUST	0.08			0.02			2
SEPTEMBER	0.90			0.36			2
OCTOBER	0.83			0.36			2
NOVEMBER	0.80			0.48			2
DECEMBER	0.99			0.71			2
ANNUAL MAXIMUM	1.48			1.46			Total No. of Samples
ANNUAL MINIMUM		0.08			0.02		24
ANNUAL AVERAGE			0.88			0.74	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale, 1974

PARAMETER / MONTH	Organic Nitrogen Mg/l						NUMBER OF SAMPLES
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	0.65			0.53			2
FEBRUARY	0.58			1.46			2
MARCH	0.26			0.41			2
APRIL	0.40			1.54			2
MAY	1.32			0.15			2
JUNE	2.73			3.25			2
JULY	0.86			1.23			2
AUGUST	1.19			4.45			2
SEPTEMBER	1.60			3.10			2
OCTOBER	2.77			2.64			2
NOVEMBER	0.90			1.61			2
DECEMBER	1.10			1.60			2
ANNUAL MAXIMUM	2.77			4.45			Total No of Samples
ANNUAL MINIMUM		0.26			0.15		24
ANNUAL AVERAGE			1.20			1.83	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1974

PARAMETER / MONTH	Phosphate Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	3.2			4.0			2
FEBRUARY	4.4			5.6			2
MARCH	3.0			5.0			2
APRIL	2.7			3.1			2
MAY							
JUNE	1.0			1.2			2
JULY							
AUGUST	5.0			9.0			2
SEPTEMBER	2.0			4.0			2
OCTOBER	8.0			12.0			2
NOVEMBER	2.0			4.0			2
DECEMBER	4.5			7.3			2
ANNUAL MAXIMUM	8.0			12.0			Total No. of Samples
ANNUAL MINIMUM		1.0			1.2		20
ANNUAL AVERAGE			3.58			5.52	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1975

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.4	6.8	7.6	7.8	6.4	7.1	4
FEBRUARY	9.2	8.8	9.0	9.5	9.2	9.4	4
MARCH	8.7	5.7	7.2	8.8	5.8	7.3	4
APRIL	8.0	8.0	8.0	7.4	5.6	6.5	4
MAY	6.3	6.2	6.3	5.3	5.2	5.3	4
JUNE	5.3	4.8	5.1	4.2	2.8	3.5	4
JULY	6.2	3.9	5.1	5.0	2.7	3.9	4
AUGUST	3.3	1.9	2.6	2.9	1.0	2.0	4
SEPTEMBER	5.2	0.8	3.0	2.3	0.4	1.4	4
OCTOBER	5.5	4.9	5.2	1.6	1.2	1.4	4
NOVEMBER	9.5	8.0	8.8	6.4	4.8	5.6	4
DECEMBER	12.0	10.5	11.3	9.8	8.8	9.3	4
ANNUAL MAXIMUM	7.3			5.9			TOTAL NO OF SAMPLES
ANNUAL MINIMUM		5.9			4.5		48
ANNUAL AVERAGE			6.6			5.2	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1975

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.9	7.5	7.7	7.9	7.4	7.7	4
FEBRUARY	7.7	7.4	7.6	7.8	7.7	7.8	4
MARCH	7.6	7.4	7.5	7.8	7.7	7.8	4
APRIL	7.9	7.7	7.8	7.8	7.7	7.8	4
MAY	7.8	7.7	7.8	7.8	7.8	7.8	4
JUNE	7.8	7.8	7.8	7.9	7.8	7.9	4
JULY	7.7	7.6	7.7	7.7	7.5	7.6	4
AUGUST	7.5	7.4	7.5	7.5	7.4	7.5	4
SEPTEMBER	7.6	7.3	7.5	7.5	7.2	7.4	4
OCTOBER	7.8	7.6	7.7	7.4	7.4	7.4	4
NOVEMBER	7.9	7.8	7.9	7.6	7.6	7.6	4
DECEMBER	7.8	7.6	7.7	7.7	7.6	7.7	4
ANNUAL MAXIMUM	7.8			7.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.6			7.6		48
ANNUAL AVERAGE			7.7			7.6	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1975

PARAMETER / MONTH	°C						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	11,0	10.0	10.5	11.0	9.5	10.3	4
FEBRUARY	10.0	10.0	10.0	11.0	8.6	9.8	4
MARCH	15.0	11.0	13.0	15.0	11.5	13.3	4
APRIL	14.0	12.0	13.0	14.0	12.5	13.3	4
MAY	17.0	15.0	16.0	16.0	16.0	16.0	4
JUNE	22.0	21.0	21.5	22.0	21.5	21.8	4
JULY	21.5	21.0	21.3	21.0	20.0	20.5	4
AUGUST	23.0	21.0	22.0	23.0	21.0	22.0	4
SEPTEMBER	22.0	19.2	20.6	21.5	19.0	20.3	4
OCTOBER	19.0	17.2	18.1	19.4	18.1	18.8	4
NOVEMBER	14.0	11.1	12.6	13.6	10.5	12.1	4
DECEMBER	9.5	8.2	8.9	9.8	7.8	8.8	4
ANNUAL MAXIMUM	16.5			16.4			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		14.7			14.7		48
ANNUAL AVERAGE			15.6			15.6	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1975

MONTH \ PARAMETER	Ammonia Nitrogen MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	3.6	2.2	1.2	3.9	1.4	2.7	4
MARCH	5.6	1.8	3.7	8.5	2.5	5.5	4
APRIL	2.8	2.5	2.7	6.3	3.5	4.9	4
MAY	4.4	2.5	3.5	7.0	6.0	6.5	4
JUNE	3.4	1.5	2.5	6.0	3.4	4.7	4
JULY	3.1	2.1	2.6	5.3	4.0	4.7	4
AUGUST	1.3	0.8	1.0	2.6	1.8	2.2	4
SEPTEMBER	2.5	1.0	1.8	2.0	2.0	2.0	4
OCTOBER	3.6	1.7	2.7	5.7	3.5	4.6	4
NOVEMBER	3.9	1.6	2.8	5.0	4.6	4.8	4
DECEMBER	2.8	2.0	2.4	6.3	5.3	5.8	4
ANNUAL MAXIMUM	3.4			5.3			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		1.8			3.5		44
ANNUAL AVERAGE			2.4			4.4	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1975

MONTH \ PARAMETER	Nitrate Nitrogen MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	1.4	1.0	1.2	1.8	1.1	1.5	4
MARCH	1.5	1.1	1.3	1.3	0.9	1.1	4
APRIL	1.0	1.0	1.0	1.3	0.9	1.1	4
MAY	1.0	1.0	1.0	1.2	1.0	1.1	4
JUNE	1.7	1.4	1.6	1.2	1.0	1.1	4
JULY	1.7	1.3	1.5	1.4	1.2	1.3	4
AUGUST	0.6	0.4	0.5	0.5	0.4	0.5	4
SEPTEMBER	0.7	0.6	0.7	0.4	0.3	0.4	4
OCTOBER	1.0	0.8	0.9	0.7	0.4	0.5	4
NOVEMBER	1.0	1.0	1.0	0.9	0.6	0.8	4
DECEMBER	1.1	0.8	1.0	1.3	0.8	1.0	4
ANNUAL MAXIMUM	1.1			1.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.9			0.8		44
ANNUAL AVERAGE			1.1			1.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1975

PARAMETER / MONTH	ORGANIC NITROGEN MG/L						
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	1.3	0.7	1.0	1.2	0.9	1.0	4
MARCH	1.1	0.9	1.0	1.6	0.5	1.1	4
APRIL	1.4	0.6	1.0	2.2	1.0	1.6	4
MAY	1.9	1.3	1.6	2.4	1.9	2.2	4
JUNE	1.2	1.1	1.2	1.7	1.5	1.6	4
JULY	2.5	1.5	2.0	2.3	2.1	2.2	4
AUGUST	2.3	2.1	2.2	2.6	2.6	2.6	4
SEPTEMBER	2.3	0.5	1.4	4.7	2.5	3.6	4
OCTOBER	2.2	0.6	1.4	4.7	2.7	3.7	4
NOVEMBER	1.5	0.5	1.0	3.5	3.0	3.3	4
DECEMBER	1.2	0.7	1.0	1.8	1.5	1.7	4
ANNUAL MAXIMUM	1.7			2.6			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.9			1.8		44
ANNUAL AVERAGE			1.3			2.2	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1975

PARAMETER / MONTH	PHOSPHATE MG/L						
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	4.6	1.3	3.0	3.7	1.3	2.5	4
MARCH	5.7	3.2	4.5	7.2	2.8	5.0	4
APRIL	3.7	2.3	3.0	4.5	1.7	3.1	4
MAY	6.5	0.2	3.3	8.4	3.0	5.7	4
JUNE	6.8	5.2	6.0	8.6	6.9	7.8	4
JULY	6.7	3.9	5.3	9.8	7.5	8.7	4
AUGUST	7.2	3.6	5.4	5.9	2.6	4.3	4
SEPTEMBER	5.3	4.6	5.0	7.1	6.4	6.8	4
OCTOBER	4.6	4.4	4.5	7.8	7.5	7.7	4
NOVEMBER	1.5	0.1	0.8	6.1	5.9	6.0	4
DECEMBER	5.9	2.6	4.3	4.7	2.0	3.4	4
ANNUAL MAXIMUM	5.3			6.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		2.9			4.3		44
ANNUAL AVERAGE			4.1			5.8	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	8 4	4.6	6.5	7.6	5.5	6.6	4
MARCH	8.4	4.6	6.5	8.1	5.5	6.8	4
APRIL	NA	NA	NA	NA	NA	NA	0
MAY	NA	NA	NA	NA	NA	NA	0
JUNE	NA	NA	NA	NA	NA	NA	0
JULY	5.2	4.9	5.1	6.8	4.4	5.6	4
AUGUST	—	4.2	4.2	—	2.6	2.6	2
SEPTEMBER	4.1	3.2	3.7	2.2	2.0	2.1	4
OCTOBER	4.6	2.6	3.6	3.1	2.7	2.9	4
NOVEMBER	5.1	2.2	3.7	—	2.9	2.9	3
DECEMBER	8.4	7.0	7.7	5.6	4.5	5.1	4
ANNUAL MAXIMUM	6.3			5.6			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		4.2			3.8		29
ANNUAL AVERAGE			5.1			4.3	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	7.7	7.3	7.5	7.6	7.3	7.5	4
MARCH	8.1	7.3	7.6	7.9	7.3	7.6	4
APRIL	NA	NA	NA	NA	NA	NA	0
MAY	NA	NA	NA	NA	NA	NA	0
JUNE	NA	NA	NA	NA	NA	NA	0
JULY	7.7	7.6	7.7	8.2	7.7	8.0	4
AUGUST	—	7.4	7.4	—	7.3	7.3	2
SEPTEMBER	7.6	7.2	7.4	7.4	7.2	7.3	4
OCTOBER	7.6	7.5	7.6	7.6	7.4	7.5	4
NOVEMBER	7.5	7.4	7.5	—	7.3	7.3	3
DECEMBER	7.7	7.4	7.6	7.5	7.4	7.5	4
ANNUAL MAXIMUM	7.7			7.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.4			7.4		29
ANNUAL AVERAGE			7.5			7.5	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	°C						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	12.2	9.3	10.8	12.0	9.5	10.8	4
MARCH	12.3	12.2	12.3	12.6	12.0	12.3	4
APRIL	NA	NA	NA	NA	NA	NA	0
MAY	NA	NA	NA	NA	NA	NA	0
JUNE	NA	NA	NA	NA	NA	NA	0
JULY	21.2	19.0	20.1	21.3	21.0	21.2	4
AUGUST	—	18.8	18.8	—	18.5	18.5	2
SEPTEMBER	22.2	18.9	20.6	22.8	19.0	20.9	4
OCTOBER	19.4	16.8	18.1	19.2	16.4	17.8	4
NOVEMBER	15.0	15.0	15.0	—	16.1	16.1	3
DECEMBER	10.3	9.2	9.8	10.2	10.0	10.1	4
ANNUAL MAXIMUM	16.1			16.4			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		14.9			15.3		29
ANNUAL AVERAGE			15.7			16.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	AMMONIA NITROGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	6.4	1.7	4.1	9.4	3.0	6.2	4
MARCH	6.5	1.5	4.0	8.9	3.8	6.4	4
APRIL	3.3	3.0	3.2	4.8	4.5	4.7	4
MAY	3.4	1.7	2.6	3.5	3.1	3.3	4
JUNE	—	1.4	1.4	—	0.1	0.1	2
JULY	1.4	1.0	1.2	1.1	1.0	1.1	4
AUGUST	1.3	1.3	1.3	1.3	1.3	1.3	4
SEPTEMBER	2.2	0.8	1.5	2.5	2.4	2.5	4
OCTOBER	2.5	0.7	1.6	6.7	1.9	4.3	4
NOVEMBER	6.2	1.0	3.6	7.8	1.7	4.8	4
DECEMBER	9.1	1.6	5.4	9.1	2.6	5.9	4
ANNUAL MAXIMUM	4.2			5.5			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		1.4			2.3		42
ANNUAL AVERAGE			2.7			3.7	

FOOTNOTE. C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	NITRATE NITROGEN MG/L						NUMBER OF SAMPLES
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	0.3	0.2	0.3	0.2	0.2	0.2	4
MARCH	1.9	0.9	1.4	4.3	0.2	2.3	4
APRIL	0.7	0.6	0.7	1.4	0.8	1.1	4
MAY	1.3	0.6	1.0	3.4	1.8	2.6	4
JUNE	–	2.6	2.6	–	1.9	1.9	2
JULY	2.4	1.6	2.0	1.6	0.8	1.2	4
AUGUST	0.8	0.8	0.8	0.6	0.5	0.6	4
SEPTEMBER	0.9	0.4	0.7	0.7	0.2	0.5	4
OCTOBER	2.3	0.7	1.5	1.9	0.9	1.4	4
NOVEMBER	1.0	0.5	0.8	0.6	0.2	0.4	4
DECEMBER	1.0	0.9	1.0	1.1	0.9	1.0	4
ANNUAL MAXIMUM	1.3			1.6			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.9			0.8		42
ANNUAL AVERAGE			1.2			1.2	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	ORGANIC NITROGEN MG/L						NUMBER OF SAMPLES
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	2.6	0.7	1.7	3.1	0.6	1.9	4
MARCH	2.0	0.8	1.4	2.1	1.9	2.0	4
APRIL	1.2	<.05	0.6	2.3	1.2	1.8	4
MAY	2.1	0.8	1.5	3.1	1.0	2.1	4
JUNE	–	1.4	1.4	–	3.7	3.7	2
JULY	1.3	0.9	1.1	3.9	1.3	2.6	4
AUGUST	2.1	0.2	1.2	3.9	2.2	3.1	4
SEPTEMBER	1.4	1.0	1.2	3.1	0.7	1.9	4
OCTOBER	1.3	0.2	0.8	3.2	0.8	2.0	4
NOVEMBER	3.2	0.8	2.0	3.2	0.1	1.7	4
DECEMBER	2.9	0.4	1.7	2.9	1.1	2.0	4
ANNUAL MAXIMUM	2.0			3.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.7			1.3		42
ANNUAL AVERAGE			1.3			2.3	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1976

PARAMETER / MONTH	PHOSPHATE MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	NA	NA	NA	NA	NA	NA	0
FEBRUARY	6.2	3.3	4.8	7.0	3.8	5.9	4
MARCH	4.4	1.9	3.2	5.9	1.2	3.6	4
APRIL	2.7	1.2	2.0	4.9	4.0	4.5	4
MAY	5.2	4.3	1.9	6.3	6.2	6.3	4
JUNE	—	7.8	7.8	—	3.4	3.4	2
JULY	5.6	4.6	5.1	9.2	5.6	7.4	4
AUGUST	7.1	1.5	4.3	8.9	6.4	7.7	4
SEPTEMBER	6.1	3.5	4.8	9.0	7.4	8.2	4
OCTOBER	7.3	4.9	6.1	8.5	6.4	7.5	4
NOVEMBER	3.6	2.8	3.2	6.9	3.5	5.2	4
DECEMBER	3.7	0.3	2.0	6.3	3.6	5.0	4
ANNUAL MAXIMUM	5.2			7.3			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		3.3			4.7		42
ANNUAL AVERAGE			4.1			5.8	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.8	5.5	6.7	6.3	5.4	5.9	4
FEBRUARY	8.1	5.0	6.6	7.2	4.4	5.8	4
MARCH	8.2	6.5	7.4	7.3	6.3	6.8	4
APRIL	7.2	6.8	7.0	6.3	6.3	6.3	4
MAY	5.2	2.8	4.0	3.7	2.8	3.3	4
JUNE	10.6	6.4	8.5	>15	4.0	9.5	4
JULY	5.0	4.8	4.9	5.0	2.5	3.8	4
AUGUST	5.2	4.5	4.9	4.9	2.4	3.7	4
SEPTEMBER	3.6	2.3	3.0	2.3	1.8	2.1	4
OCTOBER	5.5	2.6	4.1	4.0	2.2	3.1	4
NOVEMBER	7.2	3.5	5.4	6.2	4.2	5.2	4
DECEMBER	6.8	4.8	5.8	5.2	4.0	4.6	4
ANNUAL MAXIMUM	6.7			6.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		4.6			3.8		48
ANNUAL AVERAGE			5.7			5.0	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.7	7.6	7.7	7.6	7.5	7.6	4
FEBRUARY	7.6	7.6	7.6	7.5	7.4	7.5	4
MARCH	7.6	7.5	7.6	7.6	7.5	7.6	4
APRIL	7.6	7.6	7.6	7.5	7.4	7.5	4
MAY	7.8	7.4	7.6	8.0	7.2	7.6	4
JUNE	7.8	7.4	7.6	8.6	7.4	8.0	4
JULY	8.2	7.5	7.9	8.6	7.3	8.0	4
AUGUST	7.6	7.4	7.5	7.6	6.4	7.0	4
SEPTEMBER	7.4	7.2	7.3	7.1	6.8	7.0	4
OCTOBER	7.7	7.3	7.5	7.4	7.1	7.3	4
NOVEMBER	7.8	7.5	7.7	7.5	7.1	7.3	4
DECEMBER	7.7	7.6	7.7	7.6	7.3	7.5	4
ANNUAL MAXIMUM	7.7			7.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.5			7.2		48
ANNUAL AVERAGE			7.6			7.5	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	°C						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	10.5	8.6	9.6	11.0	8.2	9.6	4
FEBRUARY	14.0	10.0	12.0	14.0	10.0	12.0	4
MARCH	12.0	12.0	12.0	13.0	11.0	12.0	4
APRIL	16.5	15.0	15.8	17.0	16.0	16.5	4
MAY	20.0	15.0	17.5	20.0	15.0	17.5	4
JUNE	23.0	20.0	21.5	24.5	21.0	22.8	4
JULY	22.0	19.0	20.5	22.0	20.6	21.3	4
AUGUST	23.5	21.0	22.3	23.0	21.0	22.0	4
SEPTEMBER	21.0	19.0	20.0	21.0	18.0	19.5	4
OCTOBER	20.5	16.0	18.3	20.5	16.0	18.3	4
NOVEMBER	16.0	12.0	14.0	16.0	13.0	14.5	4
DECEMBER	13.7	10.0	11.9	13.2	10.0	11.6	4
ANNUAL MAXIMUM	17.7			17.9			TOTAL No. OF SAMPLES
ANNUAL MINIMUM		14.8			15.0		48
ANNUAL AVERAGE			16.3			16.5	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	AMMONIA - NITROGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	-	3.6	3.6	-	6.0	6.0	2
FEBRUARY	9.6	1.8	5.7	10.0	2.5	6.3	4
MARCH	9.9	5.0	7.5	11.0	9.5	10.3	4
APRIL	2.8	2.0	2.4	6.7	3.9	2.0	4
MAY	2.0	1.4	1.7	2.8	1.1	2.0	4
JUNE	1.4	0.6	1.0	2.2	0.8	1.5	4
JULY	1.4	0.1	0.8	1.7	0.1	0.9	4
AUGUST	0.2	0.2	0.2	0.5	0.2	0.4	4
SEPTEMBER	1.4	1.0	1.2	1.2	0.7	1.0	4
OCTOBER	0.7	0.6	0.7	0.9	0.6	0.8	4
NOVEMBER	1.5	0.6	1.1	1.8	1.5	1.7	4
DECEMBER	-	1.0	1.0	-	4.0	4.0	2
ANNUAL MAXIMUM	3.1			3.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		1.5			2.6		44
ANNUAL AVERAGE			2.2			3.1	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	NITRATE NITROGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	-	0.7	0.7	-	1.1	1.1	2
FEBRUARY	0.9	0.9	0.9	1.1	1.0	1.1	4
MARCH	0.8	0.7	0.8	1.0	0.6	0.8	4
APRIL	1.0	0.8	0.9	0.9	0.8	0.9	4
MAY	3.9	1.1	2.5	3.4	1.0	2.2	4
JUNE	3.1	1.3	2.2	2.6	2.0	2.3	4
JULY	1.2	1.0	1.1	2.2	0.7	1.5	4
AUGUST	0.9	0.5	0.7	0.7	0.7	0.7	4
SEPTEMBER	0.9	0.6	0.8	0.9	0.3	0.6	4
OCTOBER	1.5	0.6	1.1	1.6	0.3	1.0	4
NOVEMBER	1.2	1.2	1.2	1.2	0.6	0.9	4
DECEMBER	-	0.3	0.3	-	0.3	0.3	2
ANNUAL MAXIMUM	1.5			1.6			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.8			0.8		44
ANNUAL AVERAGE			1.1			1.1	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	ORGANIC NITROGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	–	1.2	1.2	–	0.6	0.6	2
FEBRUARY	2.4	0.5	1.5	2.0	0.5	1.3	4
MARCH	3.1	1.4	2.3	4.0	2.5	3.3	4
APRIL	0.5	0.3	0.4	2.0	0.9	1.5	4
MAY	3.1	1.4	2.3	4.5	1.2	2.9	4
JUNE	1.2	0.1	0.7	1.4	1.4	1.4	4
JULY	3.8	1.7	2.8	6.1	2.5	4.3	4
AUGUST	4.5	3.2	3.9	6.2	4.7	5.5	4
SEPTEMBER	3.6	2.3	3.0	8.3	7.0	7.7	4
OCTOBER	7.8	0.2	4.0	12.0	1.3	6.7	4
NOVEMBER	7.1	1.1	4.1	12.0	2.7	7.4	4
DECEMBER	–	0.1	0.1	–	1.0	1.0	2
ANNUAL MAXIMUM	3.7			5.8			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		1.1			2.2		44
ANNUAL AVERAGE			2.2			3.6	

FOOTNOTE: C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Sunnyvale 1977

PARAMETER / MONTH	PHOSPHATE MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	–	4.3	4.3	–	5.6	5.6	2
FEBRUARY	7.1	3.0	5.1	6.9	3.6	5.3	4
MARCH	6.5	4.5	5.5	7.5	2.5	5.0	4
APRIL	4.3	3.4	3.9	7.7	4.9	6.3	4
MAY	6.9	1.8	4.4	7.6	3.2	5.4	4
JUNE	10.0	2.8	6.9	8.8	6.9	7.9	4
JULY	8.9	4.6	6.8	10.0	7.6	8.8	4
AUGUST	8.4	3.8	6.1	11.0	6.4	8.7	4
SEPTEMBER	7.9	2.7	5.3	11.0	6.3	8.7	4
OCTOBER	7.7	5.1	6.4	9.0	6.0	7.5	4
NOVEMBER	7.8	3.5	5.7	9.6	4.0	6.8	4
DECEMBER	–	1.0	1.0	–	1.9	1.9	2
ANNUAL MAXIMUM	7.6			8.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		3.5			4.9		44
ANNUAL AVERAGE			5.1			6.5	

FOOTNOTE: C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

6. UNION - ALVARADO

Yearly summaries for Alvarado Plant,
1973 - 1977

Location Key:

C-1 50 feet from outfall

C-R 5000 feet downstream in Alameda Creek

ANNUAL RECEIVING WATER DATA
SUMMARY

Union-Alvarado 1973

PARAMETER	DISSOLVED OXYGEN Mg/l						
MONTH	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	9.0	9.0	9.0	8.7	8.6	8.65	2
FEBRUARY	9.6	8.8	9.2	8.8	8.8	8.8	2
MARCH	8.7	8.6	8.65	8.8	8.7	8.75	2
APRIL	8.3	8.3	8.3	8.0	8.0	8.0	1
MAY	8.5	8.5	8.5	8.1	7.9	8.0	2
JUNE	6.4	6.2	6.3	6.3	6.1	6.2	3
JULY	5.5	5.4	5.45	5.1	5.0	5.05	2
AUGUST	3.9	3.2	3.55	2.7	2.5	2.6	2
SEPTEMBER	6.2	6.2	6.2	4.3	4.3	4.3	1
OCTOBER	7.4	7.3	7.35	7.4	5.1	6.25	2
NOVEMBER	7.2	7.2	7.2	7.2	7.2	7.2	1
DECEMBER	8.2	8.2	8.2	8.0	8.0	8.0	1
ANNUAL MAXIMUM	9.6			8.8			Total No. of Samples
ANNUAL MINIMUM		3.2			2.5		21
ANNUAL AVERAGE			7.32			6.82	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union - Alvarado 1979

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.55	7.5	7.58	7.5	7.5	7.5	2
FEBRUARY	7.4	7.3	7.35	7.3	7.3	7.3	2
MARCH	7.9	7.8	7.85	7.8	7.7	7.75	2
APRIL	7.5	7.5	7.5	7.5	7.5	7.5	1
MAY	8.0	7.8	7.9	8.1	7.7	7.9	2
JUNE	7.35	7.25	7.3	7.4	7.3	7.3	3
JULY	7.6	7.5	7.55	7.5	7.3	7.4	2
AUGUST	7.5	7.5	7.5	7.5	7.5	7.5	2
SEPTEMBER	7.3	7.3	7.3	7.3	7.3	7.3	1
OCTOBER	8.2	8.0	8.1	7.9	7.4	7.65	2
NOVEMBER	7.6	7.6	7.6	7.65	7.65	7.65	1
DECEMBER	7.8	7.8	7.8	7.7	7.7	7.7	1
ANNUAL MAXIMUM	8.2			8.1			Total No. of Samples
ANNUAL MINIMUM		7.25			7.3		21
ANNUAL AVERAGE			7.61			7.54	

FOOTNOTE C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union - Alvarado 1974

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY							
FEBRUARY							
MARCH							
APRIL	5.30	5.10	5.17	5.40	5.00	5.20	3
MAY							
JUNE	5.40	5.30	5.35	8.40	5.70	7.05	2
JULY	6.60	6.60	6.60	5.20	5.20	5.20	1
AUGUST	5.20	5.20	5.20	5.90	5.90	5.90	1
SEPTEMBER	6.90	5.40	6.20	6.40	5.30	5.85	2
OCTOBER	7.40	6.80	7.20	7.20	6.00	6.60	2
NOVEMBER	8.30	8.20	8.25	8.10	8.00	8.05	2
DECEMBER	8.70	8.60	8.65	8.60	8.40	8.50	2
ANNUAL MAXIMUM	8.70			8.60			Total No. of Samples
ANNUAL MINIMUM		5.10			5.00		15
ANNUAL AVERAGE			6.58			6.54	

FOOTNOTE: C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Alvarado 1974

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY							
FEBRUARY							
MARCH							
APRIL	7.8	7.7	7.73	7.9	7.6	7.7	3
MAY							
JUNE	7.85	7.8	7.82	8.0	7.9	7.95	2
JULY	7.6	7.6	7.6	7.6	7.6	7.6	1
AUGUST	7.5	7.5	7.5	7.5	7.5	7.5	1
SEPTEMBER	7.8	7.6	7.7	7.7	7.6	7.65	2
OCTOBER	7.7	7.5	7.6	7.5	7.3	7.4	2
NOVEMBER	7.75	7.7	7.72	7.75	7.7	7.72	2
DECEMBER	7.65	7.6	7.62	7.6	7.6	7.6	2
ANNUAL MAXIMUM	7.85			8.0			Total No. of Samples
ANNUAL MINIMUM		7.5			7.3		15
ANNUAL AVERAGE			7.66			7.64	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Alvarado 1975

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	9.7	9.7	9.7	10.1	10.1	10.1	1
FEBRUARY	8.2	8.2	8.2	8.4	8.4	8.4	1
MARCH	8.8	8.8	8.8	8.5	8.5	8.5	1
APRIL	8.5	8.5	8.5	8.4	8.4	8.4	1
MAY	9.5	9.5	9.5	6.9	6.9	6.9	1
JUNE	36	3.6	36	4.8	4.8	4.8	1
JULY	6.5	6.5	6.5	4.5	4.5	4.5	1
AUGUST	7.2	7.2	7.2	5.4	5.4	5.4	1
SEPTEMBER	6.1	6.1	6.1	5.5	5.5	5.5	1
OCTOBER	8.0	8.0	8.0	6.8	5.8	5.8	1
NOVEMBER	8.7	8.7	8.7	8.0	8.0	8.0	1
DECEMBER	7.9	7.9	7.9	6.8	6.8	6.8	1
ANNUAL MAXIMUM	9.7			10.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		36			4.5		12
ANNUAL AVERAGE			7.7			6.9	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Alvarado 1976

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			13.4			10.4	1
FEBRUARY			13.2			10.9	1
MARCH			8.7			5.0	1
APRIL			7.0			4.8	1
MAY			5.0			5.5	1
JUNE			5.9			5.4	1
JULY			5.0			4.5	1
AUGUST			6.2			4.8	1
SEPTEMBER			6.1			4.7	1
OCTOBER			6.0			4.9	1
NOVEMBER			5.3			4.5	1
DECEMBER			6.8			6.1	1
ANNUAL MAXIMUM	13.4			10.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		5.0			4.5		12
ANNUAL AVERAGE			6.8			6.0	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Alvarado 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			8.6			8.2	1
FEBRUARY			8.3			8.2	1
MARCH			8.9			7.5	1
APRIL			7.5			7.5	1
MAY			7.6			7.3	1
JUNE			7.7			7.6	1
JULY			7.7			7.2	1
AUGUST			7.6			7.5	1
SEPTEMBER			7.5			7.5	1
OCTOBER			7.7			7.6	1
NOVEMBER			7.0			7.1	1
DECEMBER			7.4			7.5	1
ANNUAL MAXIMUM	8.9			8.2			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.0			7.1		12
ANNUAL AVERAGE			7.8			7.6	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union - Alvarado 1977

MONTH \ PARAMETER	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			8.6			4.9	1
FEBRUARY			11.6			10.1	1
MARCH			6.4			4.0	1
APRIL			7.6			5.8	1
MAY			7.7			4.1	1
JUNE			8.4			6.3	1
JULY			9.7			32.0	1
AUGUST			8.9			7.2	1
SEPTEMBER			6.0			4.8	1
OCTOBER			6.1			6.2	1
NOVEMBER			8.1			6.6	1
DECEMBER			7.3			4.9	1
ANNUAL MAXIMUM	11.6			32.0			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		6.0			4.0		12
ANNUAL AVERAGE			8.0			8.1	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union - Alvarado 1977

MONTH \ PARAMETER	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.7			7.6	1
FEBRUARY			8.4			7.8	1
MARCH			7.3			7.1	1
APRIL			7.8			7.6	1
MAY			7.5			7.5	1
JUNE			8.6			7.8	1
JULY			8.0			8.1	1
AUGUST			7.3			7.1	1
SEPTEMBER			7.5			7.5	1
OCTOBER			7.8			7.6	1
NOVEMBER			7.7			7.6	1
DECEMBER			7.4			7.3	1
ANNUAL MAXIMUM	8.6			8.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.2			7.1		12
ANNUAL AVERAGE			7.7			7.6	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

7. UNION - IRVINGTON

Yearly summaries for Irvington
Plant, 1973 1977

Location Key:

C-1 50 feet from outfall

C-R At town of Drawbridge on Mud Slough.

ANNUAL RECEIVING WATER DATA
SUMMARY

Union Irvington 1973

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	6.20	6.20	6.20	7.20	7.20	7.20	1
FEBRUARY	3.70	3.70	3.70	5.60	5.60	5.60	1
MARCH	0.20	0.10	0.15	0.00	0.00	0.00	2
APRIL	4.30	4.30	4.30	1.40	1.40	1.40	1
MAY	7.80	7.80	7.80	8.40	8.40	8.40	1
JUNE	1.10	1.10	1.10	0.40	0.40	0.40	1
JULY	1.40	1.40	1.40	0.70	0.50	0.60	2
AUGUST	5.90	3.20	4.55	4.00	2.40	3.20	2
SEPTEMBER	6.00	6.00	6.00	3.40	3.40	3.40	1
OCTOBER	6.20	6.20	6.20	4.80	4.80	4.80	1
NOVEMBER	6.60	6.50	6.55	5.80	5.80	5.80	2
DECEMBER	3.90	3.90	3.90	2.90	2.00	2.45	2
ANNUAL MAXIMUM	7.80			8.40			Total No of Samples
ANNUAL MINIMUM		0.10			0.00		17
ANNUAL AVERAGE			4.32			3.60	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union · Irvington 1973

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.4	7.4	7.4	7.4	7.4	7.4	1
FEBRUARY	7.3	7.3	7.3	7.3	7.3	7.3	1
MARCH	7.4	7.3	7.35	7.4	7.3	7.35	2
APRIL	7.6	7.6	7.6	7.5	7.5	7.5	1
MAY	7.3	7.3	7.3	7.5	7.5	7.5	1
JUNE	7.4	7.4	7.4	7.3	7.3	7.3	1
JULY	7.3	7.25	7.28	7.35	7.2	7.28	2
AUGUST	7.4	7.3	7.35	7.7	7.2	7.45	2
SEPTEMBER	7.3	7.3	7.3	7.4	7.4	7.4	1
OCTOBER	7.4	7.4	7.4	7.4	7.4	7.4	1
NOVEMBER	7.6	7.6	7.6	7.6	7.6	7.6	2
DECEMBER	7.5	7.5	7.5	7.5	7.5	7.5	2
ANNUAL MAXIMUM	7.6			7.7			Total No of Samples
ANNUAL MINIMUM		7.25			7.2		17
ANNUAL AVERAGE			7.40			7.42	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union · Irvington 1974

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	6.6	6.6	6.6	5.5	5.0	5.25	2
FEBRUARY	3.4	3.4	3.4	2.3	2.3	2.3	1
MARCH	3.9	3.8	3.85	2.8	2.8	2.8	2
APRIL	3.8	3.8	3.8	0.0	0.0	0.0	1
MAY	3.4	3.4	3.4	2.8	2.8	2.8	1
JUNE	4.1	4.1	4.1	3.1	3.1	3.1	1
JULY	2.0	2.0	2.0	2.0	2.0	2.0	1
AUGUST	2.7	2.7	2.7	1.2	1.2	1.2	1
SEPTEMBER	1.6	1.6	1.6	0.4	0.4	0.4	1
OCTOBER	1.7	1.7	1.7	1.7	1.7	1.7	1
NOVEMBER	4.6	4.6	4.6	4.2	4.2	4.2	1
DECEMBER	4.2	4.2	4.2	3.3	3.3	3.3	1
ANNUAL MAXIMUM	6.6			5.5			Total No of Stations
ANNUAL MINIMUM		1.6			0.0		14
ANNUAL AVERAGE			3.5			2.4	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union - Irvington 1974

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.4	7.4	7.4	7.4	7.4	7.4	2
FEBRUARY	7.3	7.3	7.3	7.3	7.3	7.3	1
MARCH	7.3	7.3	7.3	7.3	7.3	7.3	2
APRIL	7.5	7.5	7.5	7.4	7.4	7.4	1
MAY	7.6	7.6	7.6	7.6	7.6	7.6	1
JUNE	7.5	7.5	7.5	7.4	7.4	7.4	1
JULY	7.5	7.5	7.5	7.4	7.4	7.4	1
AUGUST	7.4	7.4	7.4	7.5	7.5	7.5	1
SEPTEMBER	7.5	7.5	7.5	7.4	7.4	7.4	1
OCTOBER	7.2	7.2	7.2	7.2	7.2	7.2	1
NOVEMBER	7.1	7.1	7.1	7.2	7.2	7.2	1
DECEMBER	7.3	7.3	7.3	7.2	7.2	7.2	1
ANNUAL MAXIMUM	7.6			7.6			Total No. of Samples
ANNUAL MINIMUM		7.1			7.2		14
ANNUAL AVERAGE			7.4			7.4	

FOOTNOTE C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Union - Irvington 1975

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	6.2	6.2	6.2	4.2	4.2	4.2	1
FEBRUARY	6.0	6.0	6.0	3.9	3.9	3.9	1
MARCH	6.9	6.9	6.9	4.8	4.8	4.8	1
APRIL	6.8	6.8	6.8	5.5	5.5	5.5	1
MAY	6.3	6.3	6.3	4.4	4.4	4.4	1
JUNE	3.1	3.1	3.1	2.0	2.0	2.0	1
JULY	3.2	3.2	3.2	3.1	3.1	3.1	1
AUGUST	5.4	5.4	5.4	12.4	12.4	12.4	1
SEPTEMBER	2.1	2.1	2.1	4.7	4.7	4.7	1
OCTOBER	1.4	1.4	1.4	1.4	1.4	1.4	1
NOVEMBER	4.0	4.0	4.0	2.6	2.6	2.6	1
DECEMBER	7.0	7.0	7.0	5.6	5.6	5.6	1
ANNUAL MAXIMUM	7.0			12.4			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		1.4			1.4		12
ANNUAL AVERAGE			4.9			4.6	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Union-Irvington 1976

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.1			5.3	1
FEBRUARY			5.8			4.4	1
MARCH			6.1			3.5	1
APRIL			3.7			1.7	1
MAY			5.1			4.3	1
JUNE			4.8			4.2	1
JULY			3.4			3.6	1
AUGUST			2.6			2.1	1
SEPTEMBER			0.8			0.0	1
OCTOBER			4.4			3.4	1
NOVEMBER			4.7			2.8	1
DECEMBER			3.9			2.3	1
ANNUAL MAXIMUM	7.1			5.3			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		0.8			0.0		12
ANNUAL AVERAGE			4.4			3.1	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA
SUMMARY

Union-Irvington 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.4			7.3	1
FEBRUARY			7.5			7.5	1
MARCH			7.6			7.8	1
APRIL			7.2			7.2	1
MAY			7.6			7.6	1
JUNE			7.4			7.4	1
JULY			7.5			7.4	1
AUGUST			7.5			7.4	1
SEPTEMBER			7.4			7.2	1
OCTOBER			7.4			7.4	1
NOVEMBER			7.4			7.3	1
DECEMBER			7.3			7.3	1
ANNUAL MAXIMUM	7.6			7.8			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.2			7.2		12
ANNUAL AVERAGE			7.4			7.4	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Union-Irvington 1977

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			8.0			6.5	1
FEBRUARY			5.8			4.0	1
MARCH			6.5			2.4	1
APRIL			5.8			3.6	1
MAY			6.0			3.6	1
JUNE			4.5			3.5	1
JULY			5.3			4.1	1
AUGUST			3.0			3.9	1
SEPTEMBER			2.3			2.1	1
OCTOBER			NA			NA	0
NOVEMBER			7.0			3.6	1
DECEMBER			7.3			4.9	1
ANNUAL MAXIMUM	8.0			6.5			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		2.3			2.1		11
ANNUAL AVERAGE			5.6			3.8	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA
SUMMARY

Union-Irvington 1977

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.7			7.7	1
FEBRUARY			7.1			7.1	1
MARCH			7.5			7.6	1
APRIL			7.9			7.7	1
MAY			7.8			7.6	1
JUNE			7.3			7.3	1
JULY			7.5			7.4	1
AUGUST			7.5			7.5	1
SEPTEMBER			7.5			7.5	1
OCTOBER			NA			NA	0
NOVEMBER			7.6			7.5	1
DECEMBER			7.4			7.3	1
ANNUAL MAXIMUM	7.9			7.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.1			7.1		11
ANNUAL AVERAGE			7.5			7.5	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

8. UNION - NEWARK

Yearly summaries for Newark Plant,
1973 - 1977

Location Key:

C-1 50 feet from outfall

C-R 4000 feet Bayward on Newark Slough, where slough opens into the Bay.

ANNUAL RECEIVING WATER DATA SUMMARY

Union - Newark 1973

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	6.6	6.4	6.5	6.3	6.2	6.25	2
FEBRUARY	9.9	9.9	9.9	9.6	9.5	9.55	2
MARCH	8.2	8.2	8.2	7.8	7.8	7.8	2
APRIL	7.9	7.9	7.9	7.5	7.4	7.45	2
MAY	8.4	8.2	8.3	7.4	7.4	7.4	2
JUNE	6.3	6.3	6.3	6.2	6.2	6.2	1
JULY	8.2	8.2	8.2	7.9	7.9	7.9	1
AUGUST	6.4	6.0	6.2	5.8	5.7	5.75	2
SEPTEMBER	7.5	7.0	7.25	7.0	6.8	6.9	2
OCTOBER	7.6	7.2	7.4	7.0	6.4	6.7	2
NOVEMBER	7.2	7.1	7.15	7.3	6.4	6.85	2
DECEMBER	7.6	7.6	7.6	7.2	7.2	7.2	1
ANNUAL MAXIMUM	9.9			9.6			Total No. of Samples
ANNUAL MINIMUM		6.0			5.7		21
ANNUAL AVERAGE			7.6			7.2	

FOOTNOTE: C-R – REFERENCE STATION
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union Newark 1973

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.6	7.6	7.6	7.6	7.5	7.55	2
FEBRUARY	7.4	7.4	7.4	7.2	7.2	7.2	2
MARCH	7.3	7.3	7.3	7.4	7.3	7.25	2
APRIL	7.6	7.6	7.6	7.6	7.6	7.6	2
MAY	7.2	7.1	7.15	7.2	7.2	7.2	2
JUNE	7.5	7.5	7.5	7.55	7.55	7.55	1
JULY	7.7	7.7	7.7	7.6	7.6	7.6	1
AUGUST	7.7	7.7	7.7	7.7	7.6	7.65	2
SEPTEMBER	7.7	7.7	7.7	7.7	7.7	7.7	2
OCTOBER	7.6	7.5	7.55	7.6	7.5	7.55	2
NOVEMBER	7.5	7.4	7.45	7.4	7.3	7.35	2
DECEMBER	7.5	7.5	7.5	7.4	7.4	7.4	1
ANNUAL MAXIMUM	7.7			7.7			Total No of Samples
ANNUAL MINIMUM		7.1			7.2		21
ANNUAL AVERAGE			7.5			7.5	

FOOTNOTE C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union Newark 1974

PARAMETER / MONTH	DISSOLVED OXYGEN Mg/l						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	8.40	8.00	8.20	8.00	7.60	7.80	2
FEBRUARY	7.10	7.00	7.05	7.70	7.60	7.65	2
MARCH	8.10	8.10	8.10	7.60	7.60	7.60	1
APRIL	8.30	8.20	8.25	8.00	7.60	7.80	2
MAY	6.60	6.60	6.60	6.30	6.30	6.30	1
JUNE	6.90	6.90	6.90	5.80	5.70	5.75	2
JULY	5.60	5.60	5.60	4.80	4.80	4.80	1
AUGUST	6.20	5.20	5.70	5.85	5.20	5.50	2
SEPTEMBER	6.00	5.95	5.98	6.00	6.00	6.00	2
OCTOBER	7.40	7.40	7.40	7.20	6.60	6.90	2
NOVEMBER	8.60	8.60	8.60	8.60	8.50	8.55	2
DECEMBER	7.00	7.00	7.00	6.70	6.60	6.65	2
ANNUAL MAXIMUM	8.60			8.60			Total No of Samples
ANNUAL MINIMUM		5.20			4.80		21
ANNUAL AVERAGE			7.12			6.78	

FOOTNOTE C R – REFERENCE STATION
C 1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union - Newark 1974

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	7.55	7.5	7.52	7.3	7.3	7.3	2
FEBRUARY	7.9	7.9	7.9	7.7	7.7	7.7	2
MARCH	7.7	7.7	7.7	7.7	7.7	7.7	1
APRIL	8.0	7.9	7.95	7.8	7.8	7.8	2
MAY	7.6	7.6	7.6	7.5	7.5	7.5	1
JUNE	7.4	7.4	7.4	7.5	7.2	7.35	2
JULY	7.7	7.7	7.7	7.5	7.5	7.5	1
AUGUST	7.6	7.5	7.55	7.6	7.5	7.55	2
SEPTEMBER	7.75	7.6	7.68	7.6	7.6	7.6	2
OCTOBER	7.7	7.6	7.65	7.5	7.4	7.45	2
NOVEMBER	7.7	7.7	7.7	7.8	7.6	7.7	2
DECEMBER	7.4	7.4	7.4	7.6	7.5	7.55	2
ANNUAL MAXIMUM	8.0			7.8			Total No. of Samples
ANNUAL MINIMUM		7.4			7.2		21
ANNUAL AVERAGE			7.65			7.56	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union - Newark 1975

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY	9.0	9.0	9.0	7.6	7.6	7.6	1
FEBRUARY	8.8	8.8	8.8	8.6	8.6	8.6	1
MARCH	8.8	8.8	8.8	8.4	8.4	8.4	1
APRIL	9.5	9.5	9.5	8.6	8.6	8.6	1
MAY	7.6	7.6	7.6	7.4	7.4	7.4	1
JUNE	6.8	6.8	6.8	5.7	5.7	5.7	1
JULY	7.2	7.2	7.2	6.5	6.5	6.5	1
AUGUST	5.8	5.8	5.8	5.4	5.4	5.4	1
SEPTEMBER	6.5	6.5	6.5	6.0	6.0	6.0	1
OCTOBER	7.8	7.8	7.8	7.4	7.4	7.4	1
NOVEMBER	9.2	9.2	9.2	10.0	10.0	10.0	1
DECEMBER	8.2	8.2	8.2	7.7	7.7	7.7	1
ANNUAL MAXIMUM	9.5			10.0			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		5.8			5.4		12
ANNUAL AVERAGE			7.9			7.4	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Newark 1976

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.6			7.3	1
FEBRUARY			8.5			7.9	1
MARCH			9.0			8.1	1
APRIL			6.9			6.0	1
MAY			4.2			4.0	1
JUNE			7.0			6.5	1
JULY			6.6			5.6	1
AUGUST			5.6			4.9	1
SEPTEMBER			6.2			4.9	1
OCTOBER			6.9			5.4	1
NOVEMBER			6.6			6.3	1
DECEMBER			6.9			6.5	1
ANNUAL MAXIMUM	9.0			8.1			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		4.2			4.0		12
ANNUAL AVERAGE			6.8			6.1	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Newark 1976

PARAMETER / MONTH	pH						
	Station C-R			Station C-1			NUMBER OF SAMPLES
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	
JANUARY			7.8			7.5	1
FEBRUARY			7.7			7.3	1
MARCH			7.4			7.2	1
APRIL			7.7			7.5	1
MAY			8.0			7.7	1
JUNE			8.1			7.9	1
JULY			7.9			7.7	1
AUGUST			7.3			7.0	1
SEPTEMBER			7.8			7.5	1
OCTOBER			7.9			7.8	1
NOVEMBER			8.1			7.6	1
DECEMBER			8.0			7.6	1
ANNUAL MAXIMUM	8.1			7.9			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.3			7.0		12
ANNUAL AVERAGE			7.8			7.5	

FOOTNOTE: C-R – REFERENCE STATION

C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Newark 1977

PARAMETER / MONTH	DISSOLVED OXYGEN MG/L						
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY			7.7			7.7	1
FEBRUARY			7.5			7.4	1
MARCH			7.8			7.3	1
APRIL			7.0			6.2	1
MAY			5.5			5.0	1
JUNE			6.1			5.6	1
JULY			6.8			6.4	1
AUGUST			6.4			5.5	1
SEPTEMBER			6.1			5.0	1
OCTOBER			4.2			5.6	1
NOVEMBER			7.4			7.6	1
DECEMBER			5.9			5.3	1
ANNUAL MAXIMUM	7.8			7.7			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		4.2			5.0		12
ANNUAL AVERAGE			6.5			6.2	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

ANNUAL RECEIVING WATER DATA SUMMARY

Union-Newark 1977

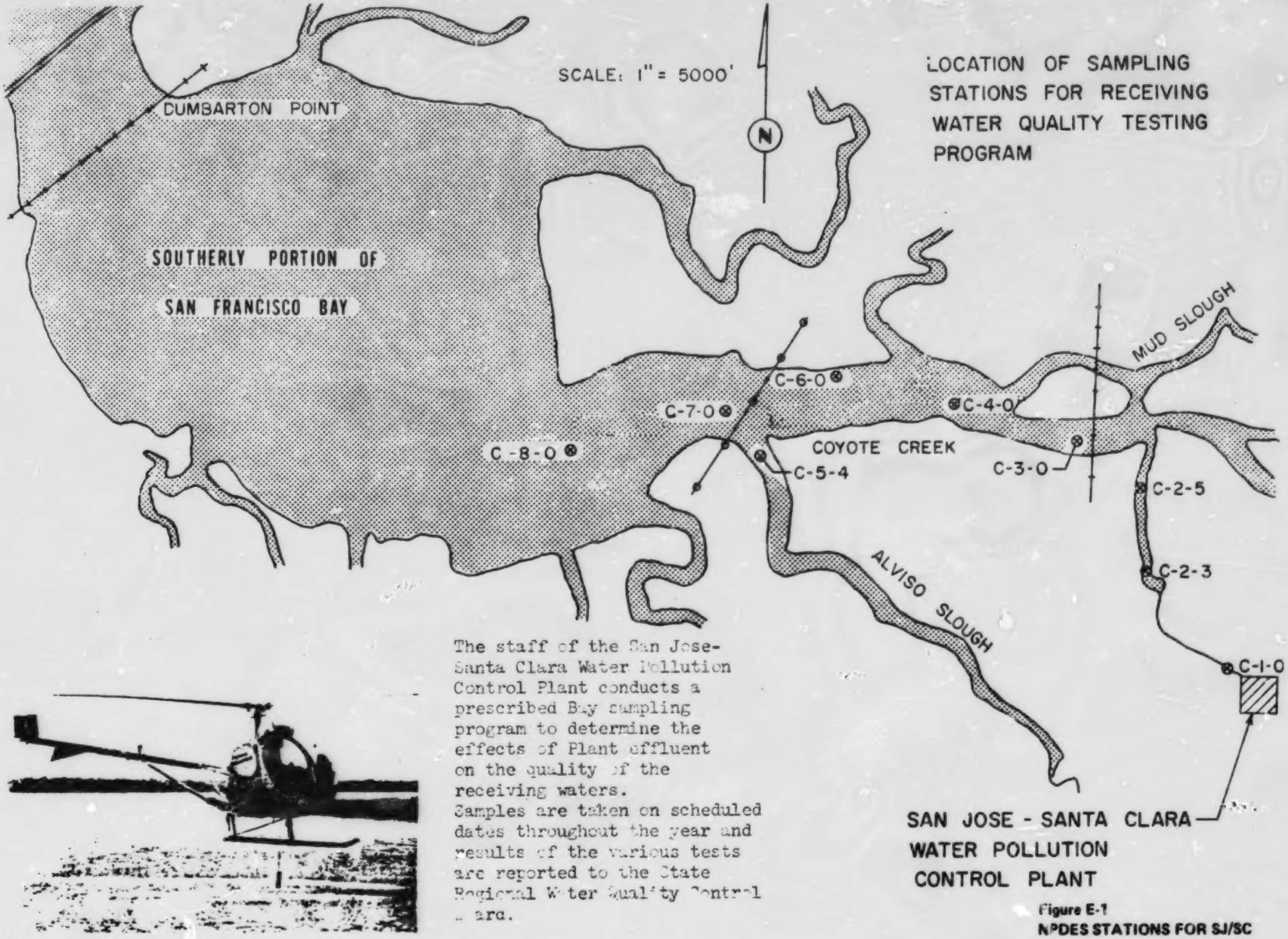
PARAMETER / MONTH	pH						
	Station C-R			Station C-1			
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	NUMBER OF SAMPLES
JANUARY			7.5			7.4	1
FEBRUARY			7.6			7.7	1
MARCH			7.9			7.8	1
APRIL			7.5			7.6	1
MAY			7.6			7.4	1
JUNE			7.6			7.6	1
JULY			7.6			7.5	1
AUGUST			7.7			7.8	1
SEPTEMBER			7.5			7.3	1
OCTOBER			7.5			7.4	1
NOVEMBER			8.0			7.8	1
DECEMBER			7.4			7.2	1
ANNUAL MAXIMUM	8.0			7.8			TOTAL NO. OF SAMPLES
ANNUAL MINIMUM		7.4			7.2		12
ANNUAL AVERAGE			7.6			7.5	

FOOTNOTE: C-R – REFERENCE STATION.
C-1 – RECEIVING WATER STATION CLOSEST TO THE DISCHARGE POINT.

Appendix E

WATER QUALITY DATA COLLECTED BY THE CITY OF SAN JOSE
DEPARTMENT OF PUBLIC WORKS, WATER POLLUTION CONTROL DIVISION

Reproduced from San Jose / Santa Clara Water Pollution Control Plant
Annual Reports 1973 and 1974


LOCATION OF SAMPLING STATIONS FOR RECEIVING WATER QUALITY TESTING PROGRAM
SCALE: 1" = 5000'
N
DUMBARTON POINT
SOUTHERLY PORTION OF SAN FRANCISCO BAY
C-8-0
C-7-0
C-6-0
C-5-4
C-4-0
C-3-0
C-2-5
C-2-3
C-1-0
COYOTE CREEK
MUD SLOUGH
ALVISO SLOUGH
SAN JOSE - SANTA CLARA WATER POLLUTION CONTROL PLANT

The staff of the San Jose-Santa Clara Water Pollution Control Plant conducts a prescribed Bay sampling program to determine the effects of Plant effluent on the quality of the receiving waters.
Samples are taken on scheduled dates throughout the year and results of the various tests are reported to the State Regional Water Quality Control Board.

Figure E-1
NPDES STATIONS FOR SJ/SC

SOUTH BAY

WATER QUALITY DATA COLLECTED BY

THE CITY OF SAN JOSE DEPARTMENT OF

PUBLIC WORKS, WATER POLLUTION CONTROL DIVISION

Reproduced From

San Jose-Santa Clara

Water Pollution Control Plant

Annual Report

1973

and

Annual Report

1974

BAY MONITORING PROGRAM

The State of California Regional Water Quality Control Board adopted the current monitoring program for sampling the south San Francisco Bay receiving waters in November 1967. A revision was made to the sampling program in late 1972, reducing the number of prescribed sampling stations from sixteen to nine. The stations are sampled twice daily, once within the two hours prior to high tide, and once within the two hours prior to low tide. The sampling frequency is once per week during the period July 1 to October 31 and twice a month during the period November 1 to June 30.

One of the surveys each month is a cooperative survey instituted by the Regional Water Quality Control Board. During this survey, all dischargers on San Francisco Bay conduct a simultaneous sampling program.

A total of 24 tests and observations are made at each station during the sampling program. The data on the following pages represent a summary of results of six of these tests. The first row of figures under each station is the high tide run and the second row is the low tide run.

1. Excerpts from the 1973 Annual Report
2. Excerpts from the 1974 Annual Report

1. Excerpts from 1973 Annual Report

MONITORING PROGRAM DATA
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1973

pH	APRIL 30, 1973	7.6	7.0	-	-	-	-	7.6	7.4	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	
DS, ppm		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DO, ppm		0.4	[illegible]	0.0	[illegible]	0.5	[illegible]	1.9	0.0	[illegible]	[illegible]	[illegible]	[illegible]	7.1	[illegible]	[illegible]	[illegible]	[illegible]	-
TEMP., °C		22.0	[illegible]	-	-	-	-	17.0	21.0	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	
SECCHI, FT.		1.0	0.5	-	-	-	-	0.7	0.5	-	-	[illegible]	1.0	-	-	[illegible]	[illegible]	-	
DEPTH, FT.		-	4.5	-	-	-	-	-	4.0	-	-	-	-	-	-	-	-	-	
pH	MARCH 27, 1973	7.2	[illegible]	-	-	-	-	7.4	7.6	-	-	7.4	-	-	-	[illegible]	[illegible]	-	
DS, ppm		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DO, ppm		5.5	5.6	3.0	3.8	2.5	[illegible]	1.5	[illegible]	1.5	0.1	[illegible]	[illegible]	-	4.8	-	[illegible]	-	-
TEMP., °C		21.0	[illegible]	-	-	-	-	[illegible]	18.5	-	-	15.0	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	
SECCHI, FT.		1.5	0.5	1.0	-	1.0	-	0.8	0.5	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	
DEPTH, FT.		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
pH	FEBRUARY 8, 1973	7.4	7.6	-	-	-	-	7.7	7.4	-	-	7.7	7.4	-	-	[illegible]	[illegible]	-	-
DS, ppm		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DO, ppm		4.3	5.9	6.1	4.5	6.1	5.1	5.5	6.9	5.8	6.1	[illegible]	[illegible]	[illegible]	5.9	7.5	6.4	7.0	[illegible]
TEMP., °C		21.0	19.0	-	-	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	
SECCHI, FT.		1.0	1.0	-	-	-	-	[illegible]	[illegible]	-	-	[illegible]	0.1	-	-	1.5	[illegible]	-	-
DEPTH, FT.		-	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
pH	JANUARY [illegible], 1973	7.3	7.3	-	-	-	-	[illegible]	7.7	-	-	[illegible]	7.7	-	-	[illegible]	[illegible]	-	-
DS, ppm		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DO, ppm		5.8	[illegible]	6.6	6.1	6.4	[illegible]	[illegible]	6.1	6.4	[illegible]	7.6	7.1	7.9	7.7	[illegible]	[illegible]	[illegible]	[illegible]
TEMP., °C		22.0	20.0	-	-	-	-	11.0	10.5	-	-	10.0	9.0	-	-	10.0	9.0	-	
SECCHI, FT.		1.0	1.0	-	-	-	-	[illegible]	[illegible]	-	-	0.3	[illegible]	-	-	[illegible]	1.5	-	-
DEPTH, FT.		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STATION		C 1		[illegible]		[illegible]		C 3		C 4		[illegible]		[illegible]		C 8			

MONITORING PROGRAM DATA
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1973

	STATION	C 1		[illegible]		[illegible]		[illegible]		C 4		[illegible]		C 7		C 8		[illegible]	
AUGUST 22, 1973	pH	7.5	7.3	-	-	-	-	7.6	7.5	-	-	7.6	7.5	-	-	7.6	7.6	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	3.4	4.2	4.0	7.2	0.9	[illegible]	3.0	4.4	3.5	4.3	4.1	5.5	5.9	7.1	6.7	7.2	5.1	[illegible]
	TEMP., °C	26.5	27.0	-	-	-	-	20.0	22.0	-	-	19.0	20.5	-	-	18.0	20.0	-	-
	SECCHI, FT.	1.0	0.5	-	-	-	-	0.8	0.5	-	-	1.0	0.5	-	-	2.5	1.5	-	-
	DEPTH, FT.	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JULY 24, 1973	pH	7.3	7.3	-	-	-	-	7.4	7.1	-	-	-	7.6	-	-	7.0	7.8	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	5.2	5.2	3.1	5.5	1.9	4.3	2.7	2.7	3.1	2.1	4.8	[illegible]	4.9	3.4	5.9	[illegible]	4.3	[illegible]
	TEMP., °C	27.0	27.0	-	-	-	-	21.0	24.0	-	-	-	22.0	-	-	-	21.3	-	-
	SECCHI, FT.	2.0	2.0	-	-	-	-	0.75	1.0	-	-	-	1.0	-	-	2.75	2.0	-	-
	DEPTH, FT.	6.0	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JUNE 26, 1973	pH	7.6	7.6	-	-	-	-	7.6	7.7	-	-	7.5	7.7	-	-	7.6	7.7	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	5.3	5.4	1.4	5.5	0.5	4.7	0.9	1.2	1.4	0.6	[illegible]	1.8	9.3	4.6	5.5	5.5	7.7	[illegible]
	TEMP., °C	27.0	28.0	-	-	-	-	23.0	27.0	-	-	22.0	[illegible]	-	-	22.5	24.5	-	-
	SECCHI, FT.	1.5	1.0	-	-	-	-	0.5	0.5	-	-	0.7	1.0	-	-	2.5	1.5	-	-
	DEPTH, FT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAY 14, 1973	pH	7.4	7.1	-	-	-	-	7.4	7.4	-	-	7.4	7.4	-	-	7.6	7.5	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	5.2	2.5	0.0	2.0	0.0	0.9	0.0	0.0	1.6	0.6	2.9	3.6	0.0	3.7	4.1	5.6	[illegible]	[illegible]
	TEMP., °C	24.0	25.9	-	-	-	-	21.0	22.0	-	-	20.0	22.0	-	-	20.0	22.0	-	-
	SECCHI, FT.	1.5	0.5	1.0	-	1.0	-	1.0	1.0	-	-	1.5	1.5	-	-	1.5	1.0	-	-
	DEPTH, FT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MONITORING PROGRAM DATA
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1973

	STATION	C 1		C [illegible]		C [illegible]		C [illegible]		C 4		[illegible]		C 7		C 8		[illegible]	
DECEMBER 18, 1973	pH	7.6	7.6	-	-	-	-	7.6	7.6	-	-	7.6	7.4	-	-	[illegible]	[illegible]	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	5.9	[illegible]	5.5	4.1	5.1	4.1	[illegible]	3.3	3.3	[illegible]	[illegible]	4.5	4.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	TEMP., °C	21.0	22.0	-	-	-	-	16.0	[illegible]	-	-	14.0	11.0	-	-	[illegible]	11.0	-	-
	SECCHI, FT.	1.0	1.5	-	-	-	-	1.0	[illegible]	-	-	0.75	1.00	-	-	[illegible]	[illegible]	-	-
	DEPTH, FT.	-	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NOVEMBER 21, 1973	pH	7.4	7.2	-	-	-	-	[illegible]	7.6	-	-	7.6	7.6	-	-	[illegible]	[illegible]	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	5.9	5.9	[illegible]	4.9	4.5	4.4	5.1	[illegible]	5.8	[illegible]	5.7	5.2	7.2	[illegible]	7.4	[illegible]	[illegible]	[illegible]
	TEMP., °C	[illegible]	23.0	-	-	-	-	-	[illegible]	-	-	11.0	-	-	-	[illegible]	[illegible]	-	-
	SECCHI, FT.	1.0	1.5	-	-	-	-	0.5	0.5	-	-	[illegible]	1.0	-	-	1.0	[illegible]	-	-
	DEPTH, FT.	6.0	[illegible]	-	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OCTOBER 22, 1973	pH	7.3	[illegible]	-	-	-	-	7.6	7.6	-	-	[illegible]	7.6	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	4.1	[illegible]	[illegible]	6.1	[illegible]	5.2	4.6	2.8	5.6	3.1	5.8	3.0	6.5	-	6.7	-	6.7	-
	TEMP., °C	21.0	24.5	-	-	-	-	16.5	19.0	-	-	-	17.5	-	-	-	-	-	-
	SECCHI, FT.	0.5	1.5	-	-	-	-	0.5	[illegible]	-	-	0.5	[illegible]	-	-	[illegible]	[illegible]	-	-
	DEPTH, FT.	[illegible]	[illegible]	-	-	-	-	-	3.0	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEPTEMBER 24, 1973	pH	7.5	7.4	-	-	-	-	[illegible]	7.4	-	-	[illegible]	[illegible]	-	-	[illegible]	[illegible]	-	-
	DS, ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DO, ppm	[illegible]	5.7	[illegible]	2.8	[illegible]	1.9	0.3	0.4	1.3	[illegible]	3.0	[illegible]	5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	TEMP., °C	[illegible]	27.0	-	-	-	-	21.0	[illegible]	-	-	[illegible]	21.0	-	-	16.0	[illegible]	-	-
	SECCHI, FT.	0.8	0.5	-	-	-	-	0.5	[illegible]	-	-	-	1.0	-	-	2.0	[illegible]	-	-
	DEPTH, FT.	[illegible]	[illegible]	-	-	-	-	-	[illegible]	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2. Excerpts from 1974 Annual Report (draft)

MONITORING PROGRAM DATA FOR PORTIONS OF COYOTE CREEK ESTUARY AND SOUTH SAN FRANCISCO BAY

Station	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH
	January 17, 1974						February 6, 1974					
C10	6.0	2.0	22.0	4.9	-	7.6	6.0	1.0	15.0	6.4	-	7.4
	4.0	1.5	22.0	5.9	-	7.4	4.5	1.0	20.0	6.7	-	7.4
C23	-	-	-	5.3	-		-	-	-	5.6	-	-
	-	-	-	5.9	-	-	-	-	-	5.8	-	-
C25	-	-	-	6.1	-	-	-	-	-	5.9	-	-
	-	-	-	6.1	-	-	-	-	-	5.3	-	-
C30	-	-	-	6.6	-	-	-	1.0	10.0	7.1	-	7.4
	1.5	0.5	16.0	5.1	-	7.4	-	0.5	13.0	4.9	-	7.6
C40	-	-	-	6.9	-	-	-	-	-	7.5	-	-
	-	-	-	5.1	-	-	-	-	-	5.1	-	-
C60	-	-	-	7.6	-	-	-	1.5	9.0	8.0	-	7.6
	-	-	-	4.3	-	-	-	-	11.0	5.8	-	-
C70	-	-	-	8.0	-	-	-	-	-	8.1	-	-
	-	-	-	5.3	-	-	-	-	-	6.5	-	-
C80	-	2.5	11.0	8.9	-	7.4	-	1.5	10.0	8.9	-	7.6
	-	2.0	15.0	7.7	-	7.4	-	1.5	10.0	7.6	-	7.6
C54	-	-	-	7.8	-	-	-	-	-	8.1	-	-
	-	-	-	7.0	-	-	-	-	-	6.1	-	-

MONITORING PROGRAM DATA FOR PORTIONS OF
COYOTE CREEK ESTUARY AND SOUTH SAN FRANCISCO BAY

Station	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH
	March 19, 1974						April 16, 1974					
C10	6.0	1.5	24.0	3.7	-	7.6	6.5	2.0	22.0	5.3	-	7.5
	3.0	1.3	22.5	5.5	-	7.5	4.0	1.0	-	6.3	-	7.4
C23	-	-	-	2.9	-	-	-	-	-	4.9	-	-
	1.5	-	-	4.9	-	-	-	-	-	6.2	-	-
C25	-	-	-	2.9	-	-	-	-	-	4.1	-	-
	-	-	-	4.6	-	-	-	-	-	6.3	-	-
C30	-	1.0	15.0	3.6	-	7.7	-	1.0	17.0	4.3	-	7.5
	1.5	1.0	20.0	3.0	-	7.6	2.0	0.5	19.0	6.3	-	7.4
C40	-	-	-	5.1	-	-	-	-	-	5.3	-	-
	-	-	-	2.7	-	-	-	-	-	4.5	-	-
C60	-	1.5	13.0	6.1	-	7.7	-	1.0	16.0	6.1	-	7.5
	-	0.8	19.0	2.9	-	7.6	-	0.5	-	3.6	-	-
C70	-	-	-	7.4	-	-	-	-	-	6.6	-	-
	-	-	-	3.5	-	-	-	-	-	4.5	-	-
C80	-	2.0	13.0	8.6	-	7.6	-	3.0	15.0	7.8	-	7.8
	-	1.5	17.0	5.7	-	7.6	-	1.5	18.0	5.9	-	7.6
C54	-	-	-	6.7	-	-	-	-	-	6.2	-	-
	-	-	-	5.9	-	-	-	-	-	6.9	-	-

MONITORING PROGRAM DATA FOR PORTIONS OF
COYOTE CREEK ESTUARY AND SOUTH SAN FRANCISCO BAY

Station	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH
	May 16, 1974						June 24, 1974					
C10	6.0	1.5	22.0	5.1	-	7.6	6.0	1.5	24.0	5.0	-	7.6
	6.0	1.5	23.0	5.9	-	7.6	-	-	-	-	-	-
C23	-	-	-	4.8	-	-	-	-	-	3.1	-	-
	-	-	-	6.1	-	-	-	-	-	-	-	-
C25	-	-	-	3.8	-	-	-	-	-	2.9	-	-
	-	-	19.0	5.7	-	7.6	-	-	-	-	-	-
C30	-	0.5	16.0	4.7	-	7.6	-	0.8	19.5	2.6	-	7.6
	-	-	-	3.8	-	-	-	-	-	-	-	-
C40	-	-	-	5.8	-	-	-	-	-	3.7	-	-
	-	-	-	4.3	-	-	-	-	-	-	-	-
C60	-	1.0	15.0	6.3	-	7.6	-	1.0	17.5	4.7	-	7.6
	0.5	-	17.0	5.6	-	7.6	-	-	-	-	-	-
C70	-	-	-	6.7	-	-	-	-	-	5.6	-	-
	-	-	-	6.3	-	-	-	-	-	-	-	-
C80	-	1.5	14.0	7.3	-	7.6	-	2.0	17.0	5.7	-	7.6
	-	1.0	16.0	7.7	-	7.6	-	-	-	-	-	-
C54	-	-	-	6.4	-	-	-	-	-	5.4	-	-
	-	-	-	6.3	-	-	-	-	-	-	-	-

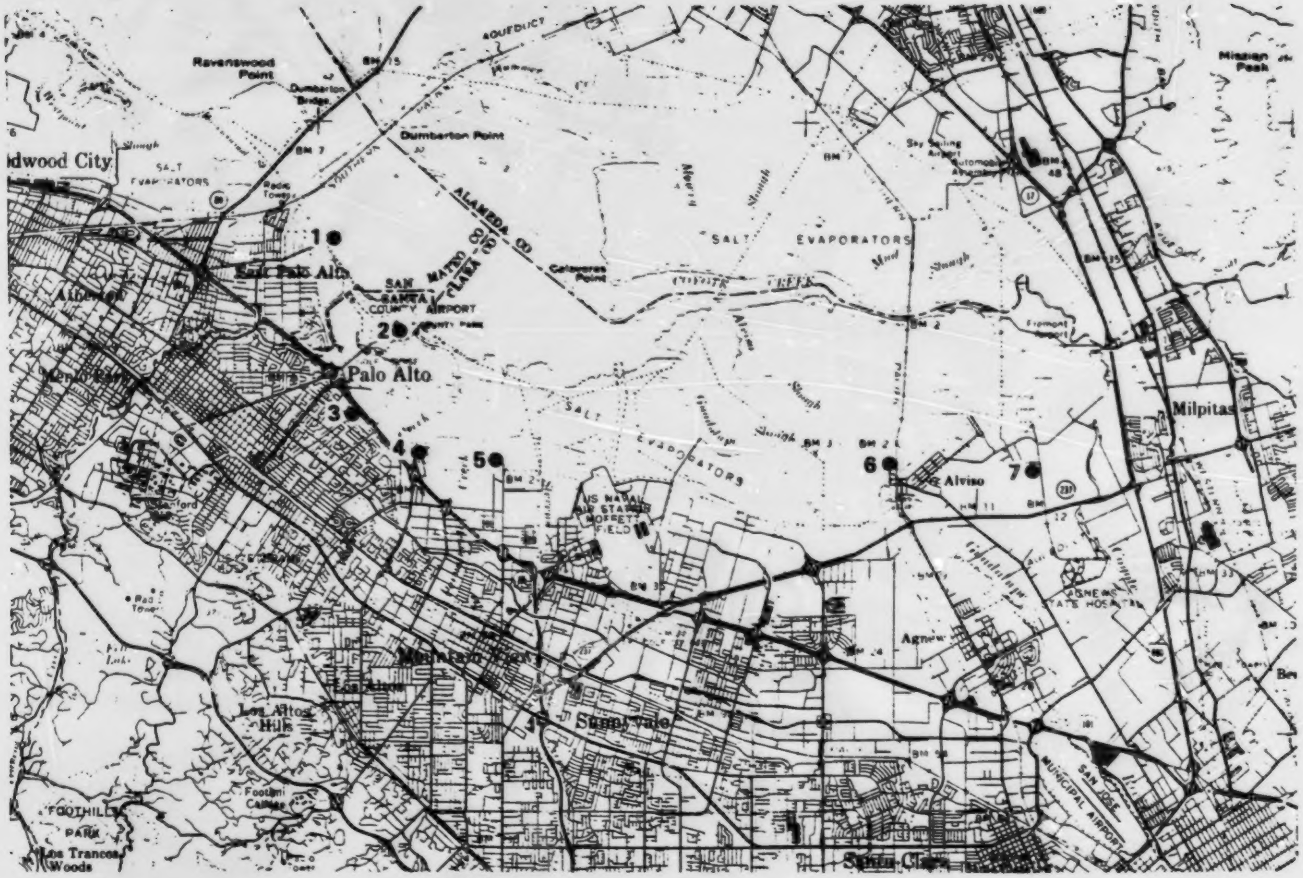
MONITORING PROGRAM DATA FOR PORTIONS OF COYOTE CREEK ESTUARY AND SOUTH SAN FRANCISCO BAY

Station	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH	Depth, Ft.	Secchi, Ft.	Temp., °C	DO, ppm	DS, ppm	pH
	July 16, 1974						August 16, 1974					
C10	7.0	1.5	25.0	5.3	-	7.5	6.5	0.5	27.0	4.3	-	7.2
	4.0	1.0	26.0	4.6	-	7.3	5.0	0.5	26.0	4.7	-	7.4
C23	-	-	-	2.0	-	-	-	-	-	0.5	-	-
	-	-	-	1.7	-	-	-	-	-	3.2	-	-
C25	-	-	-	2.7	-	-	-	-	-	1.5	-	-
	-	-	-	4.5	-	-	-	-	-	3.3	-	-
C30	-	0.5	20.0	2.9	-	7.6	-	0.5	24.0	1.7	-	7.6
	-	0.5	21.0	4.7	-	7.6	-	0.5	24.0	4.3	-	7.6
C40	-	-	-	3.6	-	-	-	-	-	3.1	-	-
	-	-	-	4.2	-	-	-	-	-	5.4	-	-
C60	-	1.0	19.0	5.0	-	7.6	-	0.5	23.0	4.5	-	7.6
	-	1.0	20.0	4.0	-	7.6	-	0.8	23.0	2.5	-	7.6
C70	-	-	-	5.6	-	-	-	-	-	5.2	-	-
	-	-	-	5.1	-	-	-	-	-	3.3	-	-
C80	-	2.0	19.0	6.1	-	7.6	-	1.0	22.0	5.7	-	7.6
	-	1.5	20.0	5.9	-	7.6	-	1.0	22.0	4.9	-	7.6
C54	-	-	-	5.2	-	-	-	-	-	4.8	-	-
	-	-	-	4.4	-	-	-	-	-	3.0	-	-

Appendix F

AMBIENT NOISE SURVEY

Prepared by Bechtel Corporation, 1975


Ravenswood Point
Dumbarton Bridge
Dumbarton Point
Redwood City
SALT EVAPORATORS
ALAMEDA CO
SAN MATEO
SANTA CLARA
East Palo Alto
Atherton
COUNTY AIRPORT
Menlo Park
Palo Alto
Stanford
US NAVAL AIR STATION MOFFETT FIELD
Mountain View
Los Altos
Los Altos Hills
Sunnyvale
FOOTHILL PARK
Los Trancos Woods
Foothill College
Santa Clara
SAN JOSE MUNICIPAL AIRPORT
Agnew
AGNEWS STATE HOSPITAL
Alviso
Milpitas
Mission Peak
COYOTE CREEK
1
2
3
4
5
6
7

LEGEND:

1● Location of Ambient Noise Monitoring Stations

Figure F-1
NOISE SURVEY

AMBIENT NOISE SURVEY
PREPARED BY BECHTEL CORPORATION , 1975
FOR PURPOSES OF
EVALUATING NOISE IMPACTS
OF THE CHOSEN PROJECT

EIS Noise Provisions

I. INTRODUCTION & SUMMARY

Ambient noise measurements were made at several locations near the proposed route for the conveyance pipeline. The ambient noise levels were relatively high due to frequent aircraft flyovers, highway traffic, and industrial operations.

The noise from the pipeline due to the flow of the treated effluent will be inaudible. Consequently, only the construction of the pipeline, particularly pile driving, will possibly produce any adverse noise effects to the nearby residents.

II. NOISE CRITERIA

Various concerned regulatory entities have promulgated noise criteria applicable to the construction and operation of the proposed conveyance system. These criteria are useful in the assessment of existing baseline conditions as well as potential noise impacts. The regulations are outlined below in tabular form and described more completely in the attachment at the end of this appendix.

TABLE 1

SUMMARY OF APPLICABLE NOISE CRITERIA AND REGULATIONS

Regulatory Entity	Criteria Summary
U.S. Environmental Protection Agency	55 dBA (L eq) recommended maximum to protect public health and welfare.
City of San Jose	Same as U.S. EPA
City of Sunnyvale	75 dBA maximum at property line of noise source 50 dBA maximum at residential zoning district property line.
City of Mountain View	65 dBA maximum for industrial areas. 65 dBA maximum for temporary activities in residential or commercial areas. Noise allowed only between 7 AM and 10 PM.
City of Palo Alto	6 dBA maximum above residential ambient levels. 8 dBA maximum above commercial ambient levels. 15 dBA maximum above ambient on public property. 70 to 86 dBA maximum for construction and industry. (See attachment for specific conditions.)

III. AMBIENT NOISE CONDITIONS

III. 1 NOISE MONITORING STATIONS

Seven locations (Figure 1) adjacent to the proposed pipeline were selected in order to measure existing ambient noise levels and to establish a baseline for assessment of the impact of the facility. These locations were selected because they were believed to typify existing conditions of the acoustical environment near noise sensitive areas, such as residence, schools, and recreational facilities within the study area. The acoustical environment in the area is currently dominated by traffic noise from Bayshore and Alviso Freeways and aircraft noise due to military aircraft flyovers from Moffett Field in Sunnyvale and civilian aircraft flyovers from airports in Palo Alto, San Jose, and San Francisco.

The geographical conditions of these seven locations are described in the footnote to Table 2.

III. 2 TECHNIQUES OF NOISE MONITORING ANALYSIS

On June 5, 1975, a Nagra IV-SJ tape recorder was employed to record the existing noise levels at the seven locations described above. A continuous 15-minute recording was made at each of these locations. In addition, manual measurements were made with a precision sound level meter (B&K Type 2206) for 15 minutes at each location.

The recorded tapes were subsequently analyzed in the laboratory with a computer. The manually measured data served primarily to check the results obtained from tape analysis.

III.3 RESULTS OF NOISE ANALYSIS

The results of the noise measurements and analysis are presented in Table 2. The A-weighted noise level exceeded 90 percent of the time (L_{90}) and the A-weighted equivalent sound level (L_{eq}) were obtained at each noise monitoring station. L_{90} will be used to describe the ambient noise levels in this report, although L_{eq} has also been chosen by the U.S. Environmental Protection Agency as an adequate description noise environments.

IV. NOISE IMPACTS OF THE PROPOSED PROJECT

IV.1 CONSTRUCTION NOISE IMPACT

The proposed pipeline alignment will consist of an on-land section and an estuarine section. Noise levels generated by construction activity for on-land section are predicted for worst case conditions. Cranes, dozers, front end loaders, backhoes, and compressors are expected to be the most significant sources of noise during construction of the on-land-alignment section. These pieces of equipment typically generate noise levels in the range of 75 to 90 dBA measured 50 feet away (EPA, 1971). Under worst condition, i.e., when all pertinent equipment is present at the site, the L_{eq} at 50 feet is estimated to be 89 dBA (EPA, 1971). No blasting, pile driving, or rock drilling is expected in the construction of the on-land alignment section. The predicted noise levels at various distances from the construction site are presented in Table 3 below:

TABLE 2

EXISTING NOISE LEVELS NEAR AND ALONG THE PRINCIPAL PIPELINE ALIGNMENT

Location Number*	Distance from Alignment (feet)	Existing Noise Levels (dBA)		Major Noise Sources
		L_{eq}	L_{90}	
1	1500	61	47	Aircraft, birds
2	500	59	50	Aircraft, road traffic, waterfowl
3	1800	57	53	Aircraft, freeway traffic
4	1500	58	51	Aircraft, freeway and street traffic, bulldozer.
5	500	65	48	Truck traffic, birds, aircraft
6	3500	65	50	Aircraft, birds, domestic animals
7	4000	58	54	Aircraft, birds, sewage treatment plant

*GEOGRAPHICAL DESCRIPTION OF NOISE MONITORING LOCATIONS (See Figure___):

1. In front of the residence at Coaley Landing at the north end of Bay Road in Menlo Park.
2. East side of duck pond near yacht club at the north end of Embarcadero Road in Palo Alto.
3. Near the home Colorado Power Station on Colorado Avenue about 300 feet southwest of Bayshore freeway in Palo Alto.
4. About 1000 feet from Bayshore freeway at the intersection of Casey and Marine Streets in Mountain View.
5. Near the residence at 2306 Stierlin Road and in front of the Public Dump site in Mountain View.
6. In the vacant lot near the residence at 970 Elizabeth Street in Alviso, San Jose.
7. In the backyard of the residence at 934 Zanker Road in San Jose.

TABLE 3

PREDICTED MAXIMUM NOISE LEVELS FROM CONSTRUCTION EQUIPMENT AND PILE DRIVING ACTIVITIES

Distance from noise source (ft)	Construction Activity* Maximum noise level (dBA)	Construction Activity* L_{eq} (dBA)	Pile Driving Maximum noise level (dBA)
50	95	89	106
100	89	83	100
200	83	77	94
400	77	71	88
800	71	65	82
1600	65	59	76
3200	59	53	70
6400	53	47	64
12800	47	41	58

* Note: Assuming three identical equipment each generating 90 dBA at 50 feet.

Pile driving is anticipated during the construction of the estuarine portion of the alignment. The sharp, repetitive sound produced by pile driving generates peak noise levels ranging from 96 to 106 dBA measured 50 feet away from the source, depending upon the type of piles and the pile driver used (Rosenberg and Slater, 1971). The predicted maximum noise levels at various distances from the site of pile driving are also presented in Table 3.

Construction noise impact is determined by comparing the existing ambient noise levels and the predicted construction noise levels with the impact criteria.

Comparison of the data in Table 2 with EPA's criteria indicates that the existing noise levels adjacent to the proposed pipeline route already exceed the level required for protection of public health and welfare. Construction noise, especially near-shore pile driving, will temporarily increase these ambient levels. Since construction of the pipeline at a given location will take place over a limited time period, however, it is anticipated that the construction noise will not significantly alter the existing noise environment in the area.

When the construction of the on-land alignment takes place within the city limit of Sunnyvale, the noise levels within 6500 feet of the construction activities may exceed 50 dBA, the desirable maximum noise level at a property line in a residential district specified by the city code. Similarly, when the construction takes place in Mountain View or Palo Alto, the noise levels may exceed 65 or 86 dBA, the maximum desirable sound levels for the boundaries of industrial area or at the property line of a project, respectively. In addition, the noise levels produced by the construction of the pipeline, both on-land and estuarine sections may exceed the existing local ambient noise levels by more than the amount specified by the Palo Alto municipal code.

IV.2 OPERATION NOISE IMPACT

There will be no audible noise from the flow of treated effluent through the pipeline since the pipe will be buried under approximately four feet of earth which will muffle any noise that may propagate along the pipe as a result of vibration induced by the pumps. Therefore, operational noise impact will not be significant.

V. MITIGATION MEASURES

The following measures can be taken to reduce or eliminate the construction noise impact:

1. Limit the construction to the hours between 8:00 AM to 6:00 PM;
2. Apply engineering techniques to control construction equipment noise wherever feasible, such as installations of proper exhaust mufflers and machine enclosures, and selection of quieter construction equipment.

References

1. U.S. Environmental Protection Agency, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", Pub. No. NTID 300.1, December 31, 1971.
2. C. J. Rosenberg & C. M. Salter: "Noise of Pile Driving Equipment" ASA Meeting, Washington, D.C., April 1971.
3. U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Pub. No. 550/9-74-004, March 1974.
4. City of San Jose, "Noise Element", The General Plan, Nov. 1974.
5. The City of Sunnyvale, "Noise Element", Sunnyvale General Plan, May 1972.
6. The City of Sunnyvale, "Noise or Sound Level", Section 19.24.020, Sunnyvale Municipal Code, 1963.
7. City of Mountain View, "Noise Element," March 1973.
8. City of Palo Alto, "Chapter 9.10. Noise", Municipal Code of the City of Palo Alto, August 1972.

ATTACHMENT

FEDERAL AND LOCAL NOISE CRITERIA AND REGULATIONS

The relevant federal government documents, and local noise ordinances of those cities which the pipeline will pass through are used as criteria to assess the noise impact of the proposed pipeline project. These criteria are briefly described below:

1. Federal Governmental Documents

The U.S. Environmental Protection Agency identifies an equivalent A-weighted sound pressure level (L_{eq}) of 55 dB as requisite to protect public health and welfare.

2. Local Noise Ordinances:

Of the five cities through which the proposed pipeline will pass, two (Palo Alto and Sunnyvale) have promulgated noise ordinances, two (San Jose and Mountain View) have developed noise policy guidelines (called *Noise Element* by both cities), and one (Santa Clara) has no formal noise document. Although the cities of San Jose and Mountain View have not enacted any noise ordinances at this time, they evaluate the noise aspect of environmental impact reports on the basis of their *Noise Element* documents. Drafts of noise ordinance are being developed by the two cities and new noise ordinances are expected to be promulgated in the near future. (Personal communication with Michael Percy of Planning Department, City of Mountain View, and John Luccehesi of Development Division, City of San Jose, June 1975). Abstracts of the noise ordinance or noise elements related to construction activities of the four cities are presented below.

City of San Jose (1974).

The *Noise Element* of the city established the same noise criteria as identified by EPA as the goal of its noise control policy.

City of Sunnyvale (1963 and 1972).

Section 19.24.020 of the Sunnyvale Municipal Code specifies that the noise or sound which is continuously or recurrently generated or produced by any activity, operation or installation shall not exceed 75 dBA at any point on the property line of the premises upon which the sound or noise is generated or produced. However, the noise or sound level shall not exceed 50 dBA at any point on such property line which forms a common boundary with property in a residential zoning district.

City of Mountain View (1973)

The *Noise Element* of the City of Mountain View recommends that, when temporary construction and similar noisy activities are necessary in residential and commercial districts, they should be limited to daytime hours (7 A.M. to 10 P.M.) and should never exceed the sound levels established for industrial areas. The sound level in the exterior of industrial area shall be kept below 65 dBA.

City of Palo Alto (1972).

A. Residential property noise limit: No more than 6 dB above the local ambient at any point outside of the property plane (Property plane is defined as a vertical plane including the property line which determine the property boundaries in space).

B. Commercial and industrial property noise limit: No more than 8 dB above the local ambient at any point outside of property plane.

C. Public property noise limit: No more than 15 DB above the local ambient at a distance of 25 feet or more.

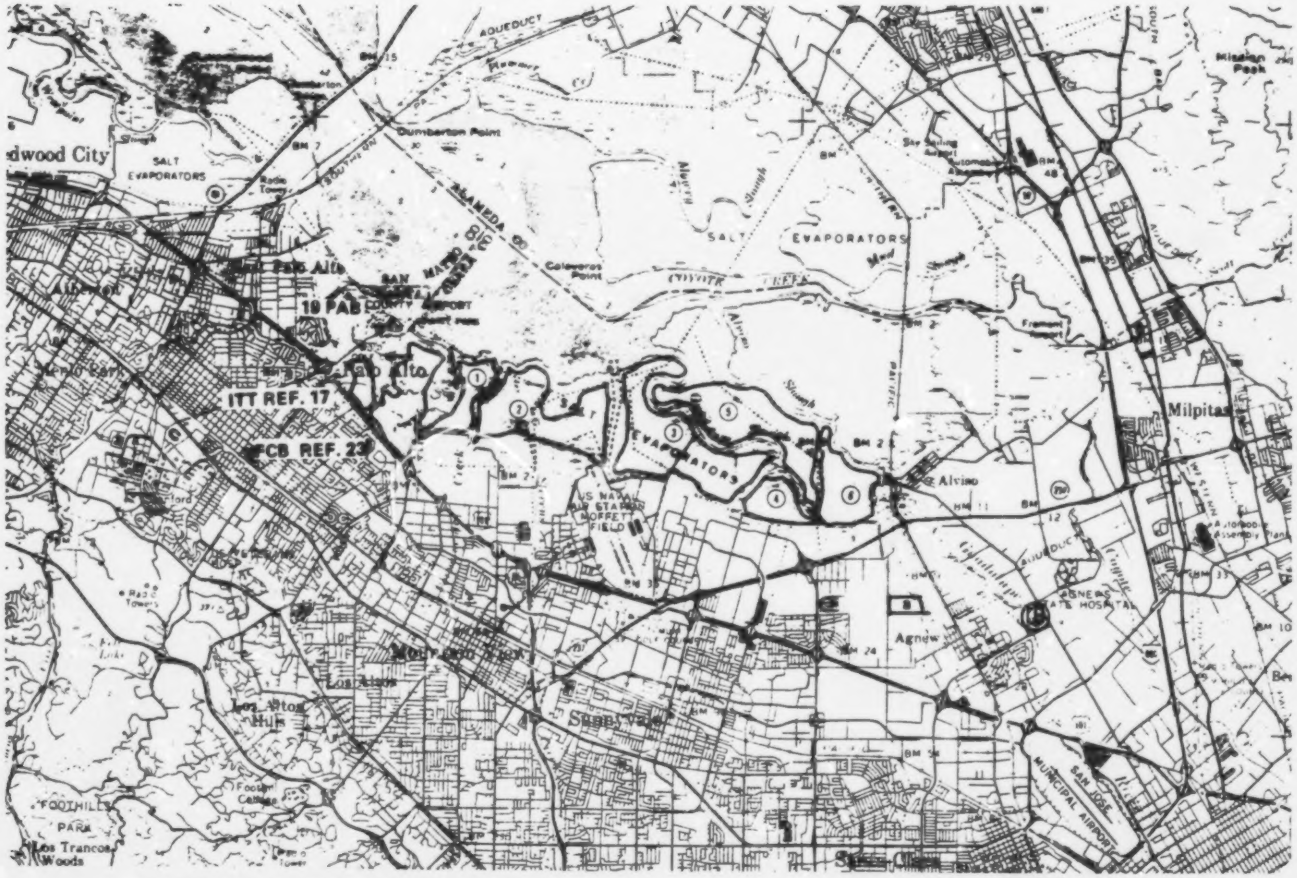
D. Demolition, construction and alteration activities which are carried out with a valid city permit are allowed to exceed the regular daytime limit of 70 dBA at 25 feet, but only between 8:00 A.M. and 8:00 P.M. (10:00 A.M. and 6:00 P.M. Sundays and holidays), and only if one of the following limits is met:

- No individual piece of equipment shall produce a noise level exceeding 83 dBA at a distance of 25 feet, OR
- The noise level at any point outside of the property line or perimeter of the project shall not exceed 86 dBA.

This dual regulation allows the individual contractor flexibility in planning his equipment use on the job to meet the Noise Ordinance limites.

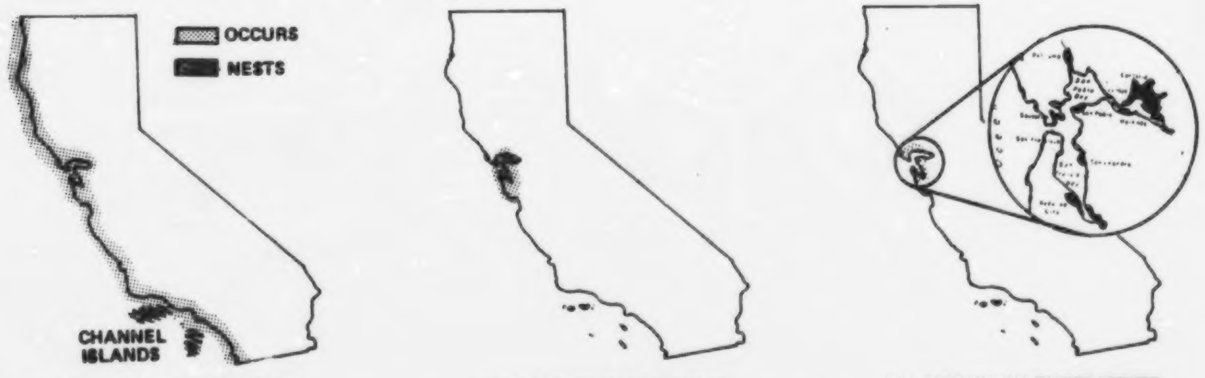
Appendix G

BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY


dwood City
SALT EVAPORATORS
Dumbarton Point
AQUEDUCT
ALAMEDA CO.
SAN MATEO COUNTY
19 PAB
Palo Alto
ITT REF. 17
FCB REF. 23
Atherton
Menlo Park
Calaveras Point
SALT EVAPORATORS
COYOTE CREEK
1
2
3
4
5
6
EVAPORATORS
US NAVAL AIR STATION MOFFETT FIELD
Alviso
Milpitas
Mission Peak
Agnew
AGNEWS STATE HOSPITAL
Mountain View
Los Altos
Los Altos Hills
Sunnyvale
Santa Clara
SAN JOSE MUNICIPAL AIRPORT
Foothill College
FOOTHILLS PARK
Los Trancos Woods
Radio Towers

1-6 – SALT PONDS CITED IN CARPELAN, 1967
a,b – ALTERNATIVE SITES STUDIED IN D.M.J.M./HAWLEY AND PETERSON, 1973

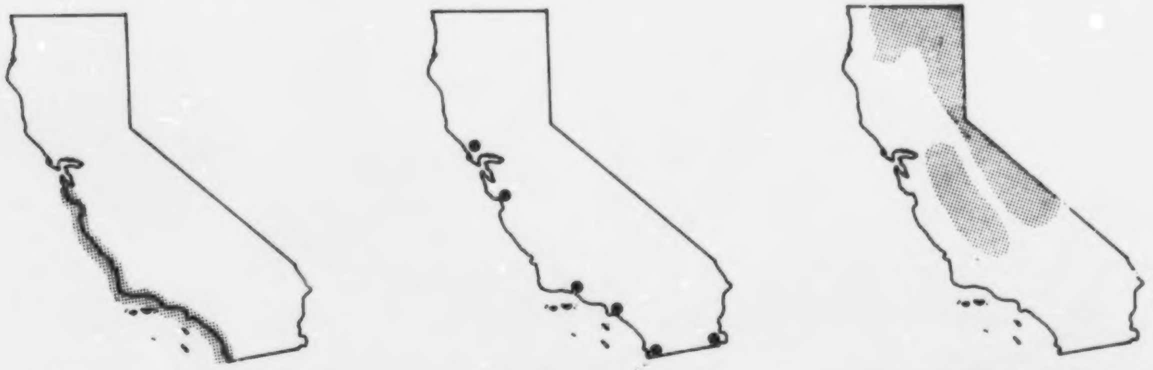
Figure G-1
LOCATIONS CITED IN TABLE G-1


OCCURS
NESTS
CHANNEL ISLANDS

CALIFORNIA BROWN PELICAN

CALIFORNIA CLAPPER RAIL

SALT MARSH HARVEST MOUSE



CALIFORNIA LEAST TERN

CALIFORNIA BLACK RAIL

AMERICAN PEREGRINE FALCON

Figure G-2
CALIFORNIA DISTRIBUTION OF RARE
OR ENDANGERED SPECIES
(Dept. of Fish and Game, 1972)

Table G-1
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal status)(2)	Occurrence (3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California(4)	Range and/or Relative Abundance in U.S.(5)	Comment(6)
TREES (GYMNOSPERMS)	(7)				
Atlas Cedar, *Cedrus atlantica*		Site "a" DMJM/Hawley and Peterson, 1973			Ornamental, imported from from northern Africa
Coast Redwood, *Sequoia sempervirens*	Dominant tree species of "Coastal Forest" – damp foggy sea air, abundant rain	Site "a" DMJM/Hawley and Peterson, 1973	Pacific Coast, south to San Luis Obispo	Pacific Coast	Used as an ornamental in project area
Shuton Cypress, *Cupressus torulosa*		Site "a" DMJM/Hawley and Peterson, 1973			Used as an ornamental, introduced from Asia
California Juniper, *Juniperus californica*	"California Oakwoods"	PG&E substation, Calif. Bus. and Transp., undated	Scattered throughout		Used as an ornamental
TREES (ANGIOSPERMS)					
Weeping Willow, *Salix babylonica*	Shorelines	Site "a," DMJM/Hawley and Peterson, 1973		North-central and northeast U.S.	Ornamental, native to China
Willow, *Salix* sp.		Martineau, undated			
Hinds Walnut, *Juglans Hindsii*	Moist soils or stream banks found in "California Oakwoods"	Site "a" and "b," DMJM/Hawley and Peterson, 1973			
Walnut, *Juglans* sp.		Martineau, undated			
Asiatic or Chinese Elm, *Ulmus parvifolia*		Site "a," DMJM/Hawley and Peterson, 1973			Introduced from China
California Bay, *Umbellularia californica*	Found on the seacoast, in "California Oakwoods" and in "Mixed Evergreen Forest" – understory	Site "a," DMJM/Hawley and Peterson, 1973; PG&E substation, Calif. Bus. and Transp., undated	Pacific Coast and west slope of Sierra Nevada Mountains	Pacific Coast of California and Oregon	
Pepper Tree, *Schinus molle*	Typical of abandoned farms and settlements	Site "b," DMJM/Hawley and Peterson, 1973		California and southern Florida	Ornamental, native to Peru
Boxelder, *Acer negundo*	Moist soils and stream banks	Site "b," DMJM/Hawley and Peterson, 1973	Central valley, coastal patches	East of Sierra Nevada Mountains	Moist soil, hardy on poor sites
Maple, *Acer* sp.		Martineau, undated			
Quince, *Cydonia ablonga*		Site "b," DMJM/Hawley and Peterson, 1973			

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Organism	Preferred Habitat (and seasonal status)(2)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California(4)	Range and/or Relative Abundance in U.S.(5)	Comment(6)
HERBS, FORBS, ETC.					
Cattail Family					
Cattail, *Typha latifolia*	Perennial marsh herb	Site "a," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973		Throughout U. S.	
Cattail, *T. angustifolia*	Fresh water	Martineau, undated		Throughout U. S.	
Pondweed Family					
Ditch Grass, *Ruppia maritima*	Immersed aquatic, alkaline or brackish water	Pond 2, Carpelan		Alaska, California, and Florida	
True Grass Family					
Wild Oat, *Avena fatua*	Cultivated and "waste" area, many soil types; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Statewide	Throughout U.S., except south Atlantic Coast, Gulf, and southern Great Plains states	Forage value
Ripgut Grass, *Bromus rigidus*		City of Palo Alto, undated; Santa Clara County Planning, 1968; Gill 1973			Introduced from Europe
Soft Chess, *B. mollis*	"Waste" areas and cultivated soil; annual or biennial	Santa Clara County Planning, 1969; Gill, 1973			Introduced from Europe
Foxtail Grass, *B. rubens*	Annual	Santa Clara County Planning, 1969; Gill, 1973			Introduced from Europe
Cheat Grass, *B. tectorum*	Roadsides and pastures on dry or gravelly soils; annual	Santa Clara County Planning, 1969; Gill, 1973	Statewide	Throughout U.S., except extreme southeast	Introduced from Mediterranean
Bermuda Grass, *Cynodon Dactylon*	Mild winters; perennials; drought resistant and tolerant of alkalinity	Santa Clara County Planning, 1969	Statewide	Abundant throughout south	Introduced from Old World
Crab Grass, *Digitoria sanguinalis*	"Waste" and cultivated areas; annual	Santa Clara County Planning, 1969 Gill, 1973	Statewide	Throughout U.S., except north Great Plains	Introduced from Europe
Salt Grass, *Distichlis spicata*	Salt marshes, alkaline soils; perennial	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill 1973; Martineau, undated	Coast and interior valleys	Both coasts of North America	Native; value as a shoreline stabilizer
Barnyard Grass, *Echinochloa crusgalli*	Agricultural lands	Martineau, undated	Statewide	Throughout U. S.	
Wild Rye, *Elymus triticoides*	Bottom lands, alkaline soils; perennial	Santa Clara County Planning, 1968; Gill, 1972; Martineau, undated			Native
Foxtail Fescue, *Festuca megalura*	Cultivated and "waste" areas	Santa Clara County Planning, 1969; Gill, 1973			Native

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Common Foxtail, *Hordeum murinum*	Cultivated and "waste" areas, roadsides, and canals; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973		Eastern states, south to Oklahoma, Arizona, Idaho, and states westward.	Introduced from Europe
Little Barley, *H. pusillum*	Alkaline soil, plains and open ground; annual	Site "a," DMJM/Hawley and Peterson, 1973	Statewide, except extreme northwest	Maine to Florida westward	Native
Farmer's Foxtail, *H. leporinum*		City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill 1973			
Mediterranean Barley, *H. Hystrix*	Flat, undisturbed, relatively dry soils	City of Palo Alto, undated; Martineau, undated			
Perennial Ryegrass., *Lolium perenne*	"Waste" areas, roadsides; short-lived perennial	Sites "a" and "b," DMJM/Hawley and Peterson, 1973	Rare	Northern U.S.	Introduced from Europe, used in grass mixtures
Australian or Italian Ryegrass, *L. multiflorum*	"Waste" areas, roadsides; cultivated as pasture or lawn; short-lived perennial	City of Palo Alto, undated Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Common especially in coast ranges	Northern U.S.	Introduced from Europe
Sickle Grass, *Parapholis incurva*	Salt marsh and strand; annual	Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Coastal counties	Oregon to southern Calif; Atlantic Coast	Introduced from Europe
Canary Grass, *Phalaris minor*	"Waste" areas, roadsides in heavy soil, annual	Santa Clara County Planning, 1969; Gill, 1973	Central, southern Calif.		Imported from Mediterranean
Timothy, *Phleum pratense*	Perennial	Site "a," DMJM/Hawley and Peterson, 1973			Commonly cultivated
Annual Bluegrass, *Poa annua*	Open ground, pastures, open woods, "waste" areas; annual	Santa Clara County Planning, 1969; Gill, 1973		Throughout U.S.	Introduced from Old World
Kentucky Bluegrass, *P. pratensis*		Santa Clara County Planning, 1969; Gill, 1973			
Rabbitfoot Grass, *Polypogon monspeliensis*	Over-irrigated, tilled soil, moist "waste" areas; annual	Site "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated		Western U.S.	Introduced from Europe
Marsh Grass, *Puccinellia maritima*		Santa Clara County Planning, 1969; Gill, 1973	Southern Del Norte County		
Cord Grass, *Spartina foliosa*	Sandy and marshy shores; perennial; saltwater	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973	Del Norte County	Pacific Coast states	Dune builders

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Sedge Family					
Sedge, *Carex* sp.	Perennial	Santa Clara County Planning, 1969; Gill, 1973			
Nutgrass, *Cyperus* sp.	Drought resistant	Santa Clara County Planning, 1969; Gill, 1973			
Tall Cyperus, *C. eragrostis*	Low salinity, standing water	Martineau, undated			
Alkali Bulrush, *Scirpus robustus*	Moist, marshy ground; perennial	Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Coastal counties	Calif., Oregon, Atlantic Coasts	
Buckwheat Family					
Knotweed or Smartweed, *Polygonum avicularia*	Hard, beaten soils; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Statewide	Northern U.S.	
Curly Dock, *Rumex crispus*	Low and neglected lands up to middle elevations; perennial	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Statewide	Throughout U.S.	Introduced from Europe and Asia
Fiddle Dock, *R. pulcher*	Meadows, moist lands, "waste" places; perennial	Santa Clara County Planning, 1969; Gill, 1973	Throughout state, very common		Introduced from Europe
Goosefoot Family					
Fat-hen, *Atriplex hastata*	Salt marshes, alkaline soil, annual	Site "a," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated		Atlantic Coast westward	Native
Red Saltbush or Redscale *A. rosea*	Annual	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated		Northern Rocky Mountains west; sparingly in eastern states	Introduced from Europe
Golden Orache, *A. hortensis*		Santa Clara County Planning, 1969; Gill, 1973			
Australian Saltbush *A. semibaccata*	Alkaline soils; perennial	Site "a," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated			Introduced from Australia

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Beet, *Beta vulgaris*	Cultivated species	City of Palo Alto, undated; Santa Clara County Planning, 1969. Gill, 1973; Martineau, undated			Food crop
Lambsquarters or Pigweed, *Chenopodium album*	Cultivated or "waste" areas, roadsides; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Statewide	Common throughout U.S.	Introduced from Old World
Pickleweed, *Salicornia pacifica*	Coastal salt marshes	City of Palo Alto, undated; Gill, 1973; Martineau, undated		Coastal U.S.	
Pickleweed, *S. ambigua*	Salt marshes	Schaub, 1971; Gill, 1973			
Common Pickleweed, *S. virginica*	Salt marshes	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969		Atlantic Coast, Pacific Coast	
Annual Pickleweed, *S. europaea*	Coastal salt marshes and inland salt and alkali marshes	Santa Clara County Planning, 1969		Atlantic Coast, local in Michigan, Wisconsin, Illinois, California, Texas	
Russian Tumbleweed, *Salsola kali*	Annual, disturbed areas	Site "b," DMJM/Hawley and Peterson, 1973	Scattered throughout state	West and central U.S., occasionally in Gulf and Atlantic Coast states	Introduced from southeast Russia and west Siberia
Salsola, *S. soda*		Santa Clara County Planning, 1969; Gill, 1973			Newly discovered species
Sea Blite, *Suaeda californica*	Coastal salt marsh and environs, perennial	Santa Clara County Planning, 1969. Gill, 1973; Martineau, undated	San Francisco Bay south		
Carpet-weed Family					
Iceplant *Mesembryanthemum nodiflorum*	Sea beaches, sandy or saline; annual	Santa Clara County Planning, 1969, Gill, 1973			
New Zealand Spinach *Tetragonia expansa*	Sea beaches; annual	Santa Clara County Planning, 1969; Gill, 1973			Introduced from Australia

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Pink Family					
Sand Spurry, *Spergularia rubra*	Roadsides and along paths; perennial	Site "a," DMJM/Hawley and Peterson, 1973			Introduced from Europe
Perennial Sand Spurry, *S. macrotheca*	Sea bluffs and salt marshes; perennial	Santa Clara County Planning, 1969; Gill, 1973	Coastal counties	Pacific states	
Sand Spurry, *S. marina*	Salt marshes	Santa Clara County Planning, 1969; Gill, 1973			
Poppy Family					
California Poppy, *Eschscholzia californica*	Annual or biennial	Santa Clara County Planning, 1969; Gill, 1973	Widespread throughout lower altitudes		State Flower – California
Mustard Family					
Black Mustard, *Brassica nigra*	Cultivated areas; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Statewide	Widespread and common throughout U.S., except central Montana and eastern Minnesota	Introduced from Eurasia
Common Yellow Mustard, *B. campestris*	Roadsides, fields, and orchards; winter annual or biennial	Site "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated		North central, eastern U.S.	Introduced from Europe
Shepherd's Purse *Capsella Bursa pastoris*	Lawns, "waste" areas; annual	Santa Clara County Planning, 1969; Gill, 1973	West of the Sierra Nevada Mountains	Throughout U.S.	Introduced from Europe
Pepper Grass, *Lepidium* sp.		Martineau, undated			
Wild Radish, *Raphanus sativus*	Fields, around habitations; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated		Northeastern U.S.	Introduced from Europe
Hedge Mustard, *Sisymbrium officinale*	"Waste" areas, wet places up to 2,500 feet elevation; annual	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Especially common west of Sierra Nevada Mountains, statewide	Throughout U.S.	Introduced from Europe

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Rose Family					
Wild Rose, *Rosa californica*	River and stream banks at lower, middle altitudes	Site "b," DMJM/Hawley and Peterson, 1973	Throughout state		Native
Wild Rasberry, *Rubus vitifolius*	Evergreen, open sandy places and woods, damp	Site "b," DMJM/Hawley and Peterson, 1973	Widely distributed – Mendocino Coast to San Luis Obispo County		Native
California Blackberry, *R. urcinus*		Martineau, undated			
Pea Family					
Bur Clover, *Medicago polymorpha*	Farmside roads and pastures	City of Palo Alto, undated	Widely distributed		Introduced from Europe, forage value
Yellow Sweet Clover, *Melilotus officinalis*	Roadside, "waste" areas	Sites "a" and "b," DMJM/Hawley and Peterson, 1973	Rare in California	North-central, northeast U.S.	Introduced from Europe
Common Vetch, *Vicia sativa*	Annual,cultivated and "waste" areas	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated			Introduced from Europe
Wood Sorrel Family					
Bermuda buttercup, *Oxalis Pes-caprae*	Cultivated areas	Santa Clara County Planning, 1969; Gill, 1973			Introduced from South Africa
Geranium Family					
Red-stem Filaree, *Erodium cicutarium*	Annual or biennial herb, most. on dry soil	Site "b," DMJM/Hawley and Peterson, 1973			Introduced from the Mediterranean area; forage value
Mallow Family					
Cheeseweed, *Malva parviflora*	"Waste" and cultivated areas; biennial	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Very abundant throughout state		Introduced from Europe
Frankenia Family					
Alkali Heath, *Frankenia grandifolia*	Alkaline soils, perennial	Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Extensive in interior plains of Great Valley, south to southern California	California	

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Carrot or Parsley Family					
Poison Hemlock, *Conium maculatum*	Shady, moist ground; biennial herb	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated	Statewide	Throughout U.S., except central Montana and eastern Minnesota	Introduced from Europe; toxic
Sweet Fennel, *Foeniculum vulgare*	"Waste" areas, perennial	Site "a," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated			Introduced from Europe
Sea Lavender Family					
Sea Lavender, *Limonium californicum*	Beaches and salt marshes	Santa Clara County Planning, 1969; Gill, 1973	Most of the length of Calif.		Native
Dogbane Family					
Scarlet Pimpernel, *Anagallis arvensis*	Sandy soil, roadsides; annual	Santa Clara County Planning, 1969; Gill, 1973	Coast and interior valleys	North-central, northeast U.S.	Introduced from Eurasia
Periwinkle, *Vinca major*	Along watercourses	Martineau, undated	Concentrated in San Francisco Bay region		Introduced from Europe
Morning Glory Family					
Wild Morning Glory, or Bindweed, *Convolvulus arvensis*	Cultivated areas; perennial	Site "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Throughout state at lower elevations	Throughout U.S., except extreme southeast and parts of Texas, New Mexico, and south Arizona	Introduced from Europe
Dodder, *Cuscuta salina*	Salt marshes, chiefly on *Salicornia*	Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated			Parasitic on marsh plants
Lily Family					
Asparagus, *Asparagus officinalis*		Site "b," DMJM/Hawley and Peterson, 1973			Introduced from Europe
Borage Family					
Fiddleneck, *Amsinckia Douglasiana*	Cultivated and "waste" areas, roadsides; annual	Site "a," DMJM/Hawley and Peterson, 1973	Widespread in Calif.		Native
Mint Family					
Spearmint, *Mentha spicata*	Wet places	Martineau, undated	Napa Valley south		Introduced

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Plantain Family					
Common Plantain, *Plantago major*	"Waste" areas and lowfields, old settlements	Site "b," DMJM/Hawley and Peterson, 1973	Common throughout state	Throughout U.S.	Introduced from Europe
Figwort Family					
California Bee Plant, *Scropularia californica*		Martineau, undated	Hills up to 6,000 feet		Native
Teasel Family					
Fuller's Teasel, *Dipsacus fullonum*	Low "waste" areas, pastures; biennial	Site "a," DMJM/Hawley and Peterson, 1973; Martineau, undated			Introduced from Europe
Composite or Daisy Family					
Dog-fennel, *Anthemis Cotula*	"Waste" and cultivated areas; annual	Santa Clara County Planning, 1969; Gill, 1973;	Widespread throughout state	Throughout U.S.	Introduced from Europe
California Mugwort, *Artemisia Douglasiana*		Martineau, undated			
Coyote Bush, *Baccharis pilularis consanguinea*	Perennial	Site "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated	Coast Range from Los Angeles north to Oregon		Native
Goldfields, *Baeria chrysotoma*	Coastal dunes to inland valleys; annual, in open grassy areas	Santa Clara County Planning, 1969; Gill, 1973	San Diego County north		
Italian Thistle, *Carduus tenuiflorus*	Moist draws or sheltered areas in hill lands	Site "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Northern California, scattered to Riverside County		Introduced from Europe
Yellow Star Thistle, *Centaurea solstitialis*	Cultivated and "waste" areas; roadsides; annual	Site "a," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; City of Palo Alto, undated; Martineau, undated	Sacramento Valley, Coast Range, Bay Area south	Extreme west, except northern Washington, scattered throughout rest of U.S.	Introduced from Europe

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Bull Thistle, *Cirsium vulgare*	Roadsides, fields	Santa Clara County Planning, 1969; Gill, 1973	Statewide	North-central, northeast U.S., throughout U.S.	Introduced from Eurasia
Brass Buttons, *Cotula coronopifolia*	Coastal counties in saline soil; perennial	Site "a," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill 1973; Martineau, undated	Abundant in coastal counties		Introduced from South Africa
Horseweed, *Conzya canadensis*	Roadsides, ditch banks, cultivated fields	Martineau, undated		Native to eastern U.S.	
Gum-plant, *Grindelia humilis*	Salt marshes	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973			
Coastal Isocoma, *Haplopappus venetus*	Alkaline or saline soils	City of Palo Alto, undated	San Francisco south		
Jaumea, *Jaumea carnosa*	Salt marshes, wet beaches; perennial	Santa Clara County Planning, 1969; Gill, 1973	Coastal parts of state	Puget Sound south	
Prickly Lettuce, *Lactuca scariola*	Cultivated and "waste" areas; annual or biennial	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Martineau, undated	Common throughout California	Throughout U.S., except extreme New Mexico	Introduced from Europe
Lasthenia, *Lasthenia glabrata*	Salt marshes; winter annual	Santa Clara County Planning, 1969; Gill, 1973	interior and coast—length of state		
Pineapple Weed, *Matricaria sauveolens*	Old farm lands, roadsides, cultivated fields; annual	Site "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Widespread throughout state		Native
Bristly Oxtongue, *Picris echiodes*	Fields, vacant lots, and "waste" areas; biennial	Site "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; Martineau, undated			Introduced from Europe
Common Groundsel, *Senecio vulgaris*	"Waste" areas; annual	Site "b," DMJM/Hawley and Peterson, 1973	Common throughout state		Introduced from Europe
Groundsel, *S. sylvaticus*		Santa Clara County Planning, 1969; Gill, 1973			
Alkali, Marsh Butterweed *S. hydrophilus*		Martineau, undated			

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Milk Thistle, *Silybum Marianum*	Cultivated areas, roadsides, irrigation canals; biennial	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; City of Palo Alto, undated; Martineau, undated			Introduced from the Mediterranean region
Sow Thistle, *Sonchus oleraceus*	Cultivated areas, roadsider ditches, "waste" areas; annual	Sites "a" and "b," DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973	Statewide	Throughout U.S.	Introduced from Europe
Dandelion, *Taraxacum officinale*	Lawns, fields, roadsides	Site "b," DMJM/Hawley and Peterson, 1973; Martineau, undated	Statewide	North-central, north-east U.S., throughout U.S.	May have been introduced from Europe
Cocklebur, *Xanthium strumarium*		Martineau, undated			Poisonous to domestic livestock
Others					
Malva Rose, *Lavatera assurgentiflora*		Martineau, undated			
Monerma, *Monerma cylindrica*		Santa Clara County Planning, 1969; Gill, 1973			
ALGAE					
Blue-green Algae					
Oscillatoria sp.		Carpelan, 1957			
Anabaena sp.		Carpelan, 1957			
Nostoc sp.					
Green Algae					
Rhizoclonium sp.	Brackish water	Ponds 1, 2, Carpelan, 1959			
Enteromorpha sp.	Brackish water, benthic	Ponds 1, 2, Carpelan, 1957			
Sea Lettuce, *Ulva* sp.	Rocky areas high in PO_4 and other nutrients, saline	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969			
Stichococcus bacilaris	Higher salinities	Ponds 1, 2, 3, 4, 5, 6, Carpelan, 1957			
Dunaliella salina	High salinity	Pond 5, Carpelan, 1957			
Bryopsis hypnoides	Benthic	Ponds 1, 2, Carpelan, 1957			
Diatoms (centrate)					
Melosira moniliformis		Ponds 1, 2, Carpelan, 1957			
Diatoms (pennate)					
Grammatophora marina	Littoral	Ponds 1, 2, 3, Carpelan, 1957			
Campylosira sp.	Littoral	Ponds 1, 2, 3, Carpelan, 1957			
Thalassionema nitzschoides	Littoral	Ponds 1, 2, 3, Carpelan, 1957			

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Pleurosigma elongatum	Littoral	Ponds 1, 2, Carpelan, 1957			
Achnanthes longipes	Littoral	Ponds 1, 2, 3, Carpelan , 1957			
Navicula sp.	Littoral	Ponds 1, 2, 3, Carpelan, 1957			
Nitzchia closterium	Littoral	Ponds 1, 2, 3, Carpelan, 1957			
N. longissima	Littoral	Ponds 1, 2, 3, Carpelan, 1957			
Amphiprora gigantea sulcata	Littoral, salinities to 50 ppm	Ponds 1, 2, 3, Carpelan, 1957			
Dinoflagellates					
Oxyrrhis marina	Salt marshes	Carpelan, 1957			
MAMMALS					
Common Opossum, *Didelphis, marsupialis*	Farming areas, woodlands, and along streams	Santa Clara County Planning, 1969	West of Sierra Nevada Mountains	Pacific Coast, east of Rocky Mountains, extreme northeast, and extreme north Great Plains	
Trowbridge Shrew, *Sorex trowbridgii*	Coniferous forests and other wooded areas	Santa Clara County Planning, 1969	Los Angeles north, except Central Valley and deserts	Pacific Coast states	
Vagrant Shrew, *S. vagrans*	Marshes, bogs, wet meadows, forest streamsides	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Martineau, undated	San Francisco north, except valleys	Pacific northwest and Rocky Mountain areas	Proposed for rare, endangered species in California
Ornate Shrew, *S ornatus*	Near streams, wet meadows	Santa Clara County Planning, 1969	Bay Area south, except valley and deserts	California	
Mole, *Scapanus latimanus(?)*	Porous soils in valleys meadows in mountains	Calif. Bus. and Transp. undated	Most of state, except Central Valley center and eastern desert	California, southern Oregon, western Nevada	
Raccoon, *Procyon lotor*	Stream and lake borders with wooded areas or rock cliffs nearby	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969	Most of state, except eastern deserts	Most of U.S., except areas in Rocky Mountains, desert	
River Otter, *Lutra canadensis*	Streams and lake borders	Santa Clara County Planning, 1969	Northern California	Throughout U.S. southwest, except extreme southwest: portions of Nevada, Utah	

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Long-tailed Weasel, *Mustela frenata*	Near water	Santa Clara County Planning, 1969	Throughout state, except southeast desert	Throughout U.S., except extreme southeast deserts of California, Nevada, New Mexico, and Arizona	
Striped Skunk, *Mephitis mephitis*	Semi-open country; mixed woods, brushland, open prairie; normally within 2 miles of water	Santa Clara County Planning, 1969	Throughout state	Throughout U.S.	
Harbor Seal, *Phoca vitulina*	Mouths of rivers, shallow harbors; limited seasonal movements	Santa Clara County Planning, 1969	Pacific Coast	Pacific Coast, Atlantic Coast south to Carolinas	
Gopher, *Thomomys bottae(?)*	Slightly moist soils, easy to work; valleys and meadows, loam soil	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969	Except extreme northeast throughout state	California through Colorado, south	
Western Harvest Mouse, *Reithrodontomys megalotis*	Grassland, open desert, weed patches, usually dense vegetation near water	Santa Clara County Planning, 1969	Throughout state	West of Mississippi River, except northwest Pacific Coast, north Rocky Mountains, and south Central Gulf states	
Salt-marsh Harvest Mouse, *R. raviventris raviventris*	Salt marshes in old nests of song sparrows, above high water level	Calif. Bus. and Transp., undated; Schaub, 1971; Santa Clara County Planning, 1969; Wandolleck, 1974; Martineau, undated	San Francisco Bay Area and lower Sacramento River Basin	California, Bay Area	Endangered species
California Ground Squirrel, *Citellus beecheyi*	Pastures, grainfields, slopes with scattered trees; rocky ridges	City of Palo Alto, undated; Santa Clara County Planning, 1969; Martineau, undated	Throughout state, except eastern desert	California, western Oregon	
California Meadow Mouse, *Microtus californicus*	Marshy ground, saltwater and fresh; wet meadows; grassy	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Martineau, undated	Shore to the mountains	California, southwest Oregon	
Norway Rat, *Rattus norvegicus*	Colonial, human habitats, wherever food is stored	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Martineau, undated	Throughout state	Throughout U.S.	
Black Rat, *R. rattus*	Human habitat, does not require soil	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969	Coastal areas and ports	Sea ports, inland	
House Mouse, *Mus musculus*	Fields, buildings	Santa Clara County Planning, 1969; Martineau, undated	Throughout state	Throughout U.S.	

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Brush Rabbit, *Sylvilagus bachmani*	Chaparral or thick brush	Santa Clara County Planning, 1969	West of Sierra Nevada Mountains	California and Oregon	
Black-tailed Hare, *Lepus californicus*	Grasslands, open areas, open prairies, and sparsely vegetated deserts	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Martineau, undated	Throughout state	West and southwest	
BIRDS					
Common Loon, *Gavia immer*	Seacoast, bays	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Most common throughout U.S., except southwest, winter on coasts	Occasional, winter
Arctic Loon, *G. arctica*	Seacoast, bays	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Pacific Coast, winter	Rare, winter
Red-Throated Loon, *G. stellata*	Seacoast, bays	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Coasts, midwest, winter and migrant	Occasional, winter
Eared Grebe, *Podiceps nigricollis*	Bays, estuaries, and other seacoast areas	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state, breeds in mountains	Coasts, extreme north, breeds in north plains states	Year-round
Horned Grebe, *P. auritus*	Seacoast, bays, estuaries	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state, salt-water	Coast, Mississippi Basin, extreme north, common winter and migrant	Year-round
Red-necked Grebe, *P. grisegena*	Seacoast, bays, estuaries	Santa Clara County Planning, 1969; USDI, 1974	Length of state, but very rare in southern third	Coasts, midwest, uncommon winter and migrant	
Western Grebe, *Aechmophorus occidentalis*	Seacoast, large bays, and coastal estuaries	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state, breeds on northern lakes	Locally abundant, west, winters on coast	Year-round
Pied-billed Grebe, *Podilymbus podiceps*	Ocean, bays, coastal lagoons, estuaries	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state, breeds on small inland lakes	West of Mississippi, fairly common	Common year-round
White Pelican, *Pelecanus erythrorhynchos*	Larger bays on coast	Ponds 1, 2, Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state	Locally common, Gulf and Pacific Coasts, west of Mississippi River	Year-round
Brown Pelican, *P. occidentalis*	Open sea and seacoast	Santa Clara County Planning, 1969; USDI, 1974	Nonbreeding, length of state	Coasts, locally common	Endangered species, occasional

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Double-crested Cormorant, *Phalacrocorax auritus*	Seacoast, bays, estuaries, harbors, and larger freshwater bodies	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau undated	Coast	Most common, coasts and inland waterways	Year-round
Brandt's Cormorant, *P. penicillatus*	Seacoast	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Pacific Coast, common	Rare, fall and winter
Pelagic Cormorant, *P. pelagicus*	Seacoast	Santa Clara County Planning, 1969; Martineau, undated	Santa Barbara Islands north to Del Norte County	Pacific Coast	
Snowy Egret, *Egretta thula*	Coastal lagoons, salt marshes, bays, estuaries	Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Not normally found in northern quarter	Southern U.S.	Abundant year-round, nesting
Great Egret, *Casmerodias albus*	Lagoons, marshes, tidal flats, river and lake shores	City of Palo Alto, undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Southern U.S.	Common year-round, nesting
Great Blue Heron, *Ardea herodias*	Salt Marshes, estuaries, mudflats	Calif. Bus. and Planning, undated; City of Palo Alto, undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Throughout U.S., except Rockies	Common year-round
Black-crowned Night Heron, *Nycticorax nycticorax*	Salt marshes and freshwater marshes	Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common year-round, nesting
Green Heron, *Butoroides virescens*	Fresh water; rarely in salt marsh	Santa Clara County Planning, 1961; USDI, 1974; Martineau, undated	Length of state	Pacific Coast and eastern U.S.	Rare, fall
Little Blue Heron, *Florida caerulea*	Coastal lagoons, salt marshes	Santa Clar County Planning, 1969; Martineau, undated	North to Marin County	Southeastern U.S.	Fall casual
American Bittern, *Botaurus lentiginosus*	Fresh and saltwater marshes	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974, Martineau, undated	West of Sierra Nevada Mountains	Throughout U.S.	Uncommon, year-round, nesting

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Least Bittern, *Ixobrychus exilis*	Freshwater marshes	USDI, 1974; Martineau, undated	San Joaquin Valley south	Coasts and midwest	Rare, fall
Mallard, *Anas platyrhynchos*	Fresh water	DMJM/Hawley and Peterson, 1973; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; Martineau, undated	Length of state, more numerous in northern half	Throughout U.S., abundant	Game species, common year-round, nesting
American Wigeon, *A. americana*	Bays, estuaries; fresh water	Calif. Bus. and Transp. undated; Santa Clara County Planning, 1969; Martineau, undated	Length of state	Throughout U.S., common	Game species, year-round
European Wigeon, *A. penelope*	Bays, estuaries; fresh water	USDI, 1974; Martineau, undated	Length of state	North coasts	Rare, fall winter
Pintail, *A. acuta*	Bays, lagoons, estuaries; fresh water	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, most common in California	Throughout U.S., abundant	Game species, common to abundant year-round, nesting
Gadwall, *A. strepera*	Fresh water	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Uncommon, throughout U.S.	Game species, year-round, nesting
Northern Shoveler, *A. clypeata*	Bays, estuaries; fresh water	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Abundant, throughout U.S.	Game species, year-round, nesting
Teal, *Anas* sp.	Varies with species	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Martineau, undated	Length of state	Throughout U.S.	Game species, year-round
Cinnamon Teal, *A. cyanoptera*	Fresh water	Gill, 1973; Gill, 1972; USDI, 1974	Length of state	Western U.S.	Game species, nesting
Lesser Scaup, *Aythya affinis*	Bays, lagoons, estuaries	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S., abundant	Game species, year-round
Canvasback, *A. valisineria*	Primarily saltwater	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Game species, year-round

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Redhead, *A. americana*	Freshwater marshes, lakes	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	U.S. except Florida	Game species, occasional winter
Ring-necked Duck, *A. collaris*	Fresh water	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Throughout U.S.	Game species, rare, winter, spring
Greater Scaup, *A. marila*	Bays, lagoons, estuaries	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Throughout U.S., locally common	Game species, year-round
Ruddy Duck, *Oxyura jamaicensis*	Lakes, ponds; saltwater bays, lagoons, estuaries	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI 1974; Martineau, undated	Length of state	Throughout state	Game species, year-round, nesting
Wood Duck, *Aix sponsa*	Fresh water with trees	Santa Clara County Planning, 1969; USDI, 1974	Uncommon, length of state	Northern Pacific Coast, east of Mississippi River	Game species, occasional, fall, winter
Common Goldeneye, *Bucephala clangula*	Saltwater	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, more common in north	U.S., except extreme southwest	Game species, uncommon year-round
Barrow's Goldeneye, *B. islandica*	Saltwater	Santa Clara County Planning, 1969; USDI, 1974	Northern coast, uncommon	Northern coasts, northwest rivers	Game species, occasional, fall, winter
Bufflehead, *B. albeola*	Saltwater	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Throughout U.S., winter, common	Game species year-round
Oldsquaw, *Clangula hyemalis*	Seacoast	Santo Clara County Planning, 1969; USDI, 1974	Length of state, uncommon to rare	Coasts	Game species, rare
White-winged Scoter, *Melanitta deglandi*	Seacoast	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Pacific Coast, northeast U.S.	Game species, rare, fall, winter
Surf Scoter, *M. perspicillata*	Saltwater	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Coasts	Game species, year-round
Black Scoter, *M. nigra*	Seacoast	Santa Clara County Planning, 1969; USDI, 1974	Uncommon to rare, length of state	Coasts	Game species, winter
Whistling Swan, *Olor columbianus*	Sheltered bays, large lakes	Santo Clara County Planning, 1969; USDI, 1974; Martineau, undated	Northern half of state	Northern U.S., common	Rare, winter
Canada Goose, *Branta canadensis*	Coastal bays, fresh water	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Throughout U.S., common breeds in north-northwest	Game species, rare to uncommon, fall, winter
Black Brant, *B. nigricans*	Shallow coastal bays	USDI, 1974	Length of state	West coast	Rare, winter

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White-fronted Goose, *Anser albifrons*	Fresh water, cultivated land	Santa Clara County Planning, 1969; USDI, 1974	Length of state, more numerous in northern half	Pacific and Mississippi flyways, migrant	Game species, occasional, fall, winter
Snow Goose, *Chen caerulescens*	Fresh water, rare on bays	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Most of U.S. on flyways, locally abundant	Game species, rare to occasional, fall, winter
Ross' Goose, *C. rossii*	Fresh water, rare on bays	Santa Clara County Planning, 1969; USDI, 1974	Primarily Sacramento and San Joaquin Valleys	Central Valley, winters	Game Species, rare, winter
Common Merganser, *Mergus merganser*	Fresh water	Santa Clara County Planning, 1969; USDI, 1974	Length of state, common in north	Throughout U.S. except extreme southwest and all of Gulf States, southeast	Rare, winter
Red-breasted Merganser, *M. serrator*	Sea coast	Santa Clara County Planning, 1969; USDI, 1974	Length of state	U.S., except Rockies	Uncommon, fall, winter
Turkey Vulture, *Cathartes aura*	Open country	DMJM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	U.S., except extreme northeast	Uncommon, year-round
White-tailed Kite, *Elanus leucurus*	Open cultivated bottom land	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	West of Sierra Nevada Mountains, deserts	Pacific Coast, Florida	Common, year-round
Marsh Hawk, *Circus cyaneus*	Marshes, grasslands	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Throughout US	Common, year-round, nesting
Red-tailed Hawk, *Buteo jamaicensis*	Grassland and savannah, open woodlands	City of Palo Alto, undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout US	Common, year-round
Sharp-shinned Hawk, *Accipiter striatus*	Open woodland	USDI, 1974	Northern Calif.	Most of US	Occasional, year-round
Cooper's Hawk, *A. cooperii*	Open woodland, riparian woodland, broken woodland	USDI, 1974	Length of state	Most of US	Occasional, year-round

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Rough-legged Hawk, *Buteo lagopus*	Open country	USDI, 1974	Length of state	Most of U.S.	Rare, fall, winter
Golden Eagle, *Aquila chrysaëtos*					
Bald Eagle, *Haliaeetus leucocephalus*	Seacoast, large lakes and rivers, coastal lagoons	USDI, 1974	Ranges length of state	Pacific Coast, Midwest, and Atlantic and Gulf Coasts	Rare, winter
Osprey, *Pandion haliaetus*	Seacoast, coastal lagoons, large bays, estuaries, rivers, large lakes	USDI, 1974	Length of state	Coasts	Rare, summer, fall
Prairie Falcon, *Falco mexicanus*	Open country	USDI, 1974	Length of state, except northwest coast	Western U.S.	Rare, fall, winter
Peregrine Falcon, *F. peregrinus*	Seacoast cliffs	USDI, 1974	Length of state	Most of U.S.	Endangered species, rare, fall, winter
Merlin, *F. columbarius*	Seacoast, open woodlands, grasslands	USDI. 1974	Length of state	Southern and western states	Rare, fall, winter
American Kestrel, *Falco sparverius*	Open country	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common, year-round
California Quail, *Lophortyx californicus*	Brushland, riparian growth edges of agricultural lands	Santa Clara County Planning, 1969; USDI, 1974	Length of state, except higher Sierra Nevada Mountains, above upper Sonoran southeast deserts	Pacific Coast states	Game species, uncommon, year-round, nesting
Ring-necked Pheasant, *Phasianus colchicus*	Brush, agricultural land	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Throughout state	Scattered, northern U.S. lowlands	Introduced game species, common year-round, nesting
American Coot, *Fulica americana*	Coasts	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, breeds only on fresh water	Throughout U.S.	Common year-round
California Clapper Rail, *Rallus longirostris*	Salt marshes	Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1972; Gill, 1972; USDI, 1974; Martineau, undated	Marin County south to San Diego County	Coasts	Endangered species, uncommon year-round, nesting

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Virginia Rail, *R. limicola*	Fresh water; edges of brackish water and saltwater marshes;	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974	Length of state	Throughout U.S.	Uncommon, year-round, nesting
Sora Rail, *Porzana carolina*	Fresh water; saltwater marshes	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974	Length of state	Throughout state	Uncommon, year-round
Black Rail, *Laterallus jamaicensis*	Salt marshes	Santa Clara County Planning, 1969; USDI, 1974	Marin to San Diego Counties, coast	Pacific Coast and eastern U.S.	Rare to occasional, fall, winter
Common Gallinule, *Gallinula chloropus*	Marshes, fresh water	Santa Clara County Planning, 1969; USDI, 1974	Mid-Sacramento Valley south and coast south (rare on coast)	South Pacific Coast and eastern U.S.	Occasional, year-round
Killdeer, *Charadrius vociferus*	Tidal flats, estuaries; fields and freshwater shores	DMJM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Very common throughout U.S.	Common, year-round,
Semipalmated Plover, *C. semipalmatus*	Tidal flats, estuaries	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Pacific Coast and east of Rockies	Occasional
Snowy Plover, *C. alexandrinus*	Sea beaches, inland brackish lakes	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Western U.S. and Gulf Coast	Uncommon, year-round
Black-bellied Plover, *Pluvialis squatarola*	Tidal flats, sea beaches and reefs	Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common, year-round
American Golden Plover, *Pluvialis dominica*	Tidal flats; fields and meadows	Santa Clara County Planning, 1969; USDI, 1974	Coast	Mississippi River Basin, migrant	Rare year-round
Western Sandpiper, *Calidris mauri*	Estuaries, tidal flats, salt marshes	Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common to abundant, year-round
Least Sandpiper, *C. minutilla*	Estuaries, tidal flats, salt marshes	Calif. Bus. and Transp., undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common to abundant, year-round

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Red Knot, *C. canutus*	Estuaries, tidal flats, salt marshes	Santa Clara County Planning, 1969; USDI, 1974	Coast	Coast and Great Lakes	Uncommon, year-round
Baird's Sandpiper, *C. bairdii*	Drier areas of estuaries	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Great Plains and Atlantic Coast	Rare, summer
Sanderling, *C. alba*	Sea beaches, tidal flats	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Throughout U.S., except southwest	Uncommon, year-round
Willet, *Catoptrophorus semipalmatus*	Sea beaches, tidal flats, marshes	Calif. Bus. and Transp., undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in northeast	Western U.S. and Gulf and Atlantic Coasts	Abundant, year-round
Marbled Godwit, *Limosa fedoa*	Estuaries, tidal flats, marshes	Calif. Bus. and Transp., undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Western U.S. and Gulf and Atlantic Coasts	Abundant, year-round
Whimbrel, *Numenius phaeopus*	Estuaries, tidal flats, beaches	Calif. Bus. and Transp., undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974	Length of state	Coasts	Occasional, winter
Long-billed Curlew, *N. americanus*	Tidal flats, estuaries, marshes	Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in northeast	Western U.S.	Common, year-round
Dunlin, *Calidris alpina*	Estuaries, tidal flats, marshes	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Pacific Coast, eastern U.S.	Abundant, winter
Short-billed Dowitcher, *Limnodromus griseus*	Estuaries, tidal flats, salt marshes	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Pacific Coast, eastern U.S.	Common, year-round
Long-billed Dowitcher, *L. scolopaceus*	Fresh water	Gill, 1972; Santa Clara County Planning, 1974; USDI, 1974; Martineau, undated	Length of date	Throughout U.S.	Common, year-round
Ruddy Turnstone, *Arenaria interpres*	Tidal flats, estuaries, mudflats	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Pacific Coast, eastern U.S.	Uncommon, winter
Pectoral Sandpiper, *Calidris melanotos*	Mudflats	USDI, 1974	Length of state	Most of U.S.	Rare, summer through fall
Black Turnstone, *Arenaria melanocephala*	Rocky shores	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Pacific Coast	Uncommon, fall, winter

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Common Snipe, *Capella gallinago*	Freshwater marshes and shorelines	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Breeds in north, found in length of state	Throughout U.S.	Uncommon, year-round
Spotted Sandpiper, *Actitis macularia*	Rocky or gravel shorelines	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in mountains, northern half	Throughout U.S.	Rare, winter
Wandering Tattler, *Heteroscelus incanus*	Offshore	Santa Clara County Planning, 1969; USDI, 1974	Length of state	Uncommon, Pacific Coast	Rare, summer through winter
Greater Yellowlegs, *Tringa melanoleuca*	Estuaries, tidal flats, marshes	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common, year-round
Lesser Yellowlegs, *T. flavipes*	Salt marshes, tidal flats,	Santa Clara County Planning, 1969;	Length of state	Throughout U.S.	Occasional, year-round
American Avocet, *Recurvirostra americana*	Estuaries, mud flats, shallow pools	Calif. Bus. and Transp., undated; Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, breeds in interior	Western U.S.	Common to abundant, year-round, nesting
Black-necked Stilt, *Himantopus mexicanus*	Shallow pools, sloughs, ponds	Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, breeds south of San Francisco	Southwestern U.S.	Common, year-round,
Wilson's Phalarope, *Steganopus tricolor*	Coast	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Sonoma County south; breeds in Great Basin and San Joaquin Valley	West of Mississippi River	Uncommon
Northern Phalarope, *Lobipes lobatus*	Coast	Gill, 1972; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Western U.S.	Common, year-round
Red Phalarope, *Phalaropus fulicarius*	Open sea, occasionally bays	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Pelagic, uncommon	Rare, year-round
Parasitic Jaeger, *Stercorarius parasiticus*	Sea coast	Santa Clara County Planning, 1969	Coast	Pelagic	Transient

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Western Gull, *Larus occidentalis*	Offshore islands and coasts	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974	Coast	Pacific Coast, common	Uncommon, year-round
Herring Gull, *L. argentatus*	Coast	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Common in northern length of state	Throughout U.S., abundant	Common
California Gull, *L. californicus*	Diverse salt and fresh waters	Pond 1, Carpelan, 1957; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in northeast	Pacific Coast and north-west, common	Abundant, year-round
Ring-billed Gull, *L. delawarensis*	Salt and fresh waters	Pond 1, Carpelan, 1957; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in northeast	Throughout U.S., common	Common to abundant, year-round
Mew Gull, *L. canus*	Coast	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Pacific Coast, winter	Rare, summer, fall
Franklin's Gull, *L. pipixan*	Coast, freshwater lakes	Santa Clara County Planning, 1939; USDI, 1974	Southern and southwest state	Great Plains	Rare, fall, winter
Bonaparte's Gull, *L. philadelphia*	Coast and larger freshwater bodies	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	East of Rockies and Pacific Coast	Abundant, year-round
Glaucous-winged Gull, *L. glaucescens*	Coast	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Coast	Pacific Coast, abundant	Abundant, year-round
Heermann's Gull, *L. heermanni*	Coast	Santa Clara County Planning, 1969; USDI, 1974	Coast	Pacific Coast, winter	Rare, fall, winter
Glaucous Gull, *L. hyperboreus*	Seacoast, bays, estuaries	USDI, 1974	Length of state	North coasts	Occasional
Thayer's Gull, *L. thayeri*	Seacoast, estuaries, bays	USDI, 1974	Coast, exact range uncertain		Uncommon, year-round; recently upgraded from Herring Gull subspecies.
Caspian Tern, *Hydroprogne caspia*	Saltwater, large rivers and lakes	Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974	Length of state	Eastern U.S. and south Pacific Coast	Viable breeding habitat diminished locally; common, spring, fall, nesting
Common Tern, *Sterna hirundo*	Seacoast, bays, estuaries	USDI, 1974	Coast, length of state	Eastern U.S.	Rare, transient

Organism	Preferred Habitat (and seasonal status)[2]	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California[4]	Range and/or Relative Abundance in U.S.[5]	Comment[6]
Forster's Tern, *Sterna forsteri*	Coast, large rivers and lakes	Ponds 1, 2, 3, Carpelan, 1957; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Marin south in winter, otherwise length of state	Throughout U.S. except Appalachians	Common, nesting
California Least Tern, *S. albifrons*	Coast	Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; Anderson, undated; USDI, 1974	San Francisco south	Coasts, Mississippi Basin	Endangered species,
Elegant Tern, *Thalasseus elegans*	Fresh water	Santa Clara County Planning, 1969; USDI, 1974	Sonoma County south	Southern California	Recent range and population expansion, rare locally
Black Tern, *Chlidonias niger*	Fresh water	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Northern and northeast state south to Salton Sea	Throughout U.S., locally common	Rare, spring through fall
Common Murre, *Uria aalge*	Seacoast	Santa Clara County Planning, 1969; USDI, 1974	Length of state, uncommon south of Monterey County	Pacific Coast, northeast Atlantic Coast	Rare, fall, winter
Mourning Dove, *Zenaida macroura*	Oak woodland, farms, urban areas	DMJM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau undated	Length of state	Throughout U.S.	Uncommon, year-round, nesting
Rock Dove, *Columba livia*		USDI, 1974	Throughout state	Throughout U.S.	Introduced
Short-eared Owl, *Asio flammeus*	Salt marshes, grass meadows, freshwater marshes, farm land	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Uncommon, formerly bred length of state
Burrowing Owl, *Speotyto cunicularia*	Dry, open rolling hills, grassland, farm land, bare earth	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, except mountains, humid forest	Western U.S.	Common, nesting
Barn Owl, *Tyto alba*	Open country	USDI, 1974	Length of state, low elevations	Most of U.S.	Uncommon, year-round
Great Horned Owl, *Bubo virginianus*	Broken oak or coniferous/ deciduous woodlands	USDI, 1974	Length of state	Throughout U.S.	Uncommon, year-round

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Vaux's Swift, *Chaetura vauxi*	Douglas Fir and/or Coast Redwood forests	USDI, 1974	Length of state in migration	West Coast	Occasional, summer
White-throated Swift, *Aeronautes saxatalis*	Deserts, foothill, mountains seacoast	USDI, 1974; Martineau, undated	Arid regions east and south of northwest coastal belt	Pacific Coast of California, southwest U.S., and Rocky Mountain area	Uncommon, year-round
Anne's Hummingbird, *Calypte anna*	Broken or mixed woodland	USDI, 1974	Southwest to San Francisco, Central Valley	Pacific Coast	Uncommon, year-round nesting
Rufou's Hummingbird, *Selasphorus rufus*	Broken Coast Redwood or Douglas Fir forests	USDI, 1974	Length of state, west of deserts, mountains	Western U.S.	Uncommon
Allen's Hummingbird, *S. sasin*	Coastal chaparral ravines or canyons	USDI, 1974	Coast	Coastal California	Uncommon, year-round, nesting
Belted Kingfisher, *Megaceryle alcyon*	Near water	Santa Clara County Planning, 1969; USDI, 1974	West of southeastern deserts, length of state	Throughout U.S.	Uncommon
Red-shafted Flicker, *Colaptes auratus*	Open woodland	Santa Clara County Planning, 1969; USDI, 1974	Length of state, except deserts	Throughout U.S. (red race in west, yellow in east)	Uncommon, nesting
Acorn Woodpecker, *Melanerpes formicivorus*	Oak Woodland	USDI, 1974	West of deserts and mountains	Pacific Coast	Rare, winter and spring
Yellow-bellied Sapsucker, *Sphyrapicus varius*	Riparian woodland	USDI, 1974	Length of state	Throughout U.S.	Uncommon, winter
Hairy Woodpecker, *Dendrocopos villosus*	Mixed and broken forest	USDI, 1974	Length of state, except deserts, Central Valley	Throughout U.S.	Rare
Downy Woodpecker, *D. pubescens*	Riparian woodland	USDI, 1974	Length of state, except east of mountains	Throughout U.S.	Uncommon, year-round,
Nuttall's Woodpecker, *D. nuttallii*	Oak woodland	USDI, 1974	Coast range north to Mendocino County	California	Rare, winter and spring

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Black Phoebe, *Sayornis nigricans*	Near fresh water	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974	Lower elevations west of Sierra north to head of Sacramento Valley and to Del Norte County	Southwest and west	Uncommon, nesting
Western Kingbird, *Tyrannus verticalis*	Open county	USDI, 1974	Length of state	Western U.S.	Occasional, spring
Ash-throated Flycatcher, *Myiarchus cinerascens*	High desert to open oak woodland	USDI, 1974	North to Mendocino, Trinity, Siskiyou, and Modoc Counties	Western U.S.	Occasional
Say's Phoebe, *Sayornis saya*	Open country	USDI, 1974	North to Sonoma County and north Sacramento Valley	Western U.S.	Occasional
Willow Flycatcher, *Empidonax traillii*	Riparian willows	USDI, 1974	Length of state	Throughout U.S.	Uncommon, fall
Hammond's Flycatcher, *E. hammondii*	Subalpine forests through deserts	USDI, 1974	South to Tulare County	Western U.S.	Occasional, spring and fall
Gray Flycatcher, *E. wrightii*	Pinyon-juniper woodland	USDI, 1974	South to Inyo County	Great Basin of the west and southwest	Occasional, spring and fall
Western Flycatcher, *E. difficilis*	Shaded woodlands with running water	USDI, 1974	Length of state	Western U.S.	Uncommon
Western Wood Peewee, *Contopus sordidulus*	Broken or mixed woodland	USDI, 1974	Length of state	Western, U.S.	Rare, spring
Olive-sided Flycatcher, *Nuttallornis borealis*	Montane coniferous forests	USDI, 1974	Length of state	Throughout U.S.	Occasional, spring and fall
Horned Lark, *Eremophila alpestris*	Grass and agricultural lands	Santa Clara County Planning, 1969; USDI, 1974	Length of state, except Sierra and humid forests, northwest Montana	Throughout U.S., except extreme southeast	Uncommon, year-round
Barn Swallow, *Hirundo rustica*	Lowlands, mud (summer)	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, scarcer in south	Throughout U.S.	Abundant, nesting

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Violet-green Swallow, *Tachycineta thalassina*	Open woodland	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, west of southeastern deserts	West of Rockies	Uncommon, year round
Tree Swallow, *Iridoprocne biocolor*	Trees with woodpecker holes (summer)	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, west of southeastern deserts	Throughout U.S.	Uncommon, nesting
Cliff Swallow, *Petrochelidon pyrrhonota*	Lowlands, open country (summer)	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, except mountains, southeastern deserts	Throughout U.S.	Abundant, nesting
Bank Swallow, *Riparia riparia*	Lowlands	USDI, 1974	Scattered west of deserts	Throughout U.S.	Rare, spring
Rough-winged Swallow, *Stelgidopteryx ruficollis*	Lowlands	USDI, 1974	Length of state	Throughout U.S.	Uncommon
Scrub Jay, *Aphelocoma coerulescens*	Mixed woodland and chaparral	USDI, 1974	Length of state, except deserts	Western U.S.	Uncommon, nesting
Common Crow, *Corvus brachyrhynchos*	Savannah; agricultural land	USDI, 1974	Central Valley, southwest and northwest coasts	Throughout U.S.	Rare, year-round
Chestnut-backed Chikadee, *Parus rufescens*	Oak and mixed woodlands	USDI, 1974	Coast from San Luis Obispo north	Pacific Coast	Uncommon, nesting
Plain Titmouse, *P. inornatus*	Oak woodlands	USDI, 1974	Length of state	Southwest U.S.	Uncommon, year-round
Bushtit, *Psaltriparus minimus*	Lowland and coastal chaparral, open woodlands	USDI, 1974	Length of state, except high mountains, deserts	Western U.S.	Uncommon, nesting
White-breasted Nuthatch, *Sitta carolinensis*	Riparian, broken oak and mixed woodlands	USDI, 1974	Length of state	Throughout U.S. except for Great Plains	Occasional, winter
Red-breasted Nuthatch, *Sitta canadensis*	Coniferous forests	USDI, 1974	Length of state	Throughout U.S.	Occasional, winter

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Brown Creeper, *Certhia familiaris*	Coastal coniferous forests, montane forests	USDI, 1974	North and northwest, south to San Luis Obispo	Throughout U.S.	Rare, winter
Wrentit, *Chamaea fasciata*	Coastal and lowland chaparral	USDI, 1974	Coast	Pacific Coast	Occasional, year-round
Long-billed Marsh Wren, *Telmatodytes palustris*	Cattail, tule, and bulrushes	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martinmaru, undated	Coast, Central Valley, Imperial Valley, Modoc plateau	Throughout U.S., abundant in limited habitat	Common, nesting
House Wren, *Troglodytes aedon*	Thickets and brush	USDI, 1974	Length of state	Throughout U.S.	Rare
Bewick's Wren, *Thryomanes bewickii*	Thickets	USDI, 1974	Length of state	Pacific Coast east to Appalachians	Common, nesting
Rock Wren, *Salpinctes obsoletus*	Rocky slopes and arroyos	USDI, 1974	Sea level to 12,000 feet	Western U.S.	Occasional, year-round
Mockingbird, *Mimus polyglottos*	Lowlands, urban and agricultural, edges of brushland, woodland	Santa Clara County Planning, 1969, USDI, 1973	North to head of Central Valley, Lassen and Humboldt Counties	Southern U.S.	Range expanding northward
Robin, *Turdus migratorius*	Forests, agricultural land with groves of trees, urban land	Santa Clara County Planning, 1969, USDI, 1974	Length of state, nests in north and in mountains	Throughout U.S.	
Varied Thrush, *Ixoreus naevius*	Dense coastal forests, cool canyons, oak woodlands, taller chaparral	USDI, 1974	Visitors throughout; breeds only in Del Norte and Humboldt Counties	Pacific Coast	Uncommon
Hermit Thrush, *Catharus guttatus*	Montane and subalpine forest, dense thickets, riparian woodlands	USDI, 1974	Length of state	Throughout U.S.	Uncommon
Swainson's Thrush, *C. ustulatus*	Thickets	USDI, 1974	Length of state	Throughout U.S.	Uncommon, spring and summer
Western Bluebird, *Sialia mexicana*	Open forests, edges of riparian forests	USDI, 1974	Length of state, except deserts	Western U.S.	Occasional, year-round
Blue-gray Gnatcatcher, *Polioptila caerulea*	Brushland with nearby trees	USDI, 1974	Foothills of Central Valley, interior coastal ranges	Southern U.S.	Rare, spring and fall

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Golden-crowned Kinglet, *Regulus satrapa*	Coastal forest to montane and subalpine forests	USDI, 1974	Coast range, inner coast range, other mountains	Throughout U.S.	Occasional
Ruby-crowned Kinglet, *R. calendula*	Montane to subalpine forests	USDI, 1974	Length of state in transit	Throughout U.S.	Common
Water Pipit, *Anthus spinoletta*	Open country, lowlands (winter)	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Common
Cedar Waxwing, *Bombycilla cedrorum*	Riparian woodlands	USDI, 1974	Length of state in transit	Throughout U.S.	Occasional
Loggerhead Shrike, *Lanius ludovicianus*	Open country	City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state, except higher portions of mountains and northeast	Throughout U.S.	Occasional, year-round
Starling, *Sturnus vulgaris*	Open country	[illegible]/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Throughout state, except northwest and southeast	Throughout U.S.	Arrived in state 1942, population expanding, common, nesting
Hutton's Vireo, *Vireo huttoni*	Live oak woodland	USDI, 1974	West of Sierra Nevada Mountains	Pacific Coast	Uncommon, year-round
Solitary Vireo, *V. solitarius*	Oak and mixed woodlands, lowland thickets, riparian	USDI, 1974	East of deserts	Southwestern U.S.	Occasional, spring and fall
Warbling Vireo, *V. gilvus*	Riparian woodlands	USDI, 1974	Length of state	Throughout U.S.	Uncommon
Yellow-rumped Warbler, *Dendroica coronata*	Forests, woodlands, thickets, urban areas	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state, breeds in all mountains except desert mountains	Western U.S.	Common, except spring
Common Yellowthroat, *Geothlypis trichas sinuosa*	Thick tangles near fresh or brackish waters (resident)	Santa Clara County Planning, 1969; Gill, 1973; USDI, 1974; Martineau, undated	Length of state	Throughout U.S. (this race in San Francisco Bay Area)	Uncommon, year-round, nesting
Orange-crowned Warbler, *Vermivora celata*	Live oaks, chaparral, riparian thickets	USDI, 1974	Length of state	Throughout U.S.	Occasional to common, year-round

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Nashville Warbler, *Vermivora ruficapilla*	Deciduous forests	USDI, 1974	West of Sierra Nevada Mountains	Pacific Coast and mid-western and eastern U.S.	Uncommon
Black-throated Gray Warbler, *Dendroica nigrescens*	Oak and mixed oak forests	USDI, 1974	Length of state	Western U.S.	Rare, spring and fall
Townsend's Warbler, *D. townsendi*	Woodlands	USDI, 1974	Length of state	Western U.S.	Occasional
Hermit Warbler, *D. occidentalis*	Woodlands	USDI, 1974	Mountain ranges length of state	Pacific Coast	Occasional, spring and fall
MacGillivray's Warbler, *Oporornis tolmiei*	Chaparral, riparian thickets	USDI, 1974	Mountain ranges south to San Francisco	Western U.S.	Occasional, spring and fall
Wilson's Warbler, *Wilsonia pusilla*	Thickets	USDI, 1974	Length of state	Throughout U.S.	Occasional
House Sparrow, *Passer domesticus*	Urban	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Throughout U.S.	Introduced, common, nesting
Meadowlark, *Sturnella neglecta*	Meadows, grasslands, savannahs, greenswards	DMJM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; Gill, 1972; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	West of Mississippi River	Common, nesting
Redwinged Blackbird, *Agelaius phoeniceus mailliardorum*	Fresh and brackish water marshes, fields, borders of water bodies	DMJM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state (this race endemic to Bay)	Throughout U.S. (this race in San Francisco Bay Area)	Common, nesting
Tricolored Blackbird, *A. tricolor*	Tules, cattails, and sedges	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Central Valley, Sonoma coast south, Modoc	California, southern Oregon	Uncommon, nesting
Brewer's Blackbird, *Euphagus cyanocephalus*	Meadows, grassland, farmland, urban land	Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	West of Mississippi River	Abundant, nesting

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Brown-headed Cowbird, *Molothrus ater*	Riparian, farmland, urban land, meadows	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Throughout state, except higher elevations, humid coastal forests	Throughout U.S.	Uncommon to occasional, year-round, nesting
Yellow-headed Blackbird, *Xanthocephalus xanthocephalus*	Freshwater marshes	USDI, 1974	Length of state	Western U.S.	Rare, winter
Northern Oriole, *Icterus galbula*	Woodlands	USDI, 1974	Length of state, except northwest coast	Throughout U.S.	Occasional to rare, nesting
Western Tanager, *Piranga ludoviciana*	Open coniferous forests and lowlands	USDI, 1974	Length of state	Western U.S.	Occasional, spring
Golden-crowned Sparrow, *Zonotrichia atricapilla*	Brushland, urban areas	Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	Pacific Coast	Uncommon
Lesser Goldfinch, *Spinus psaltria*	Riparian and open woodlands	Santa Clara County Planning, 1969; USDI, 1974	West of Cascades, Sierra, and deserts	Western, southwestern	Common, nesting
Black-headed Grosbeak, *Pheucticus melanocephalus*	Open forests	USDI, 1974	Length of state	Western U.S.	Common, spring and summer
Purple Finch, *Carpodacus purpureus*	Woodlands	USDI, 1974	West of Sierra Nevada Mountains	U.S., except Rocky Mountains	Rare, winter and spring
Pine Siskin, *Spinus pinus*	Coniferous forest	USDI, 1974	Mountains	Northern and western U.S.	Rare, winter and spring
House Finch (Linnet) *Carpodacus mexicanus*	Open land and woodland edges urban and agricultural lands	DMBM/Hawley and Peterson, 1973; Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Length of state	Western U.S.	Common, nesting
American Goldfinch, *Spinus tristis*	Riparian, orchards, savannah	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	West of Cascades, Sierra, and deserts	Common throughout U.S.	Common, nesting

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White-crowned Sparrow, *Zonotrichia leucophrys*	Meadows, thickets, lake edges, coastal brushland	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; USDI, 1974; Martineau, undated	Length of state	U.S., except southeast and mid-Atlantic Coasts	Common
Savannah Sparrow, *Passerculus sandwichensis alaudinus*	Marshes, grasslands	Calif. Bus. and Transp., undated; City of Palo Alto, undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	Coast south to Monterey and scattered to Mexico, northeast plateau to Owens Valley, lowlands west of deserts	Throughout U.S. (this is coastal race)	Common, nesting
Salt Marsh Song Sparrow, *Melospiza melodia pusillula*	Salt marsh edges and marshes of *Salicornia, Grindelia,* San Francisco	Calif. Bus. and Transp., undated; Santa Clara County Planning, 1969; Gill, 1973; Gill, 1972; USDI, 1974; Martineau, undated	San Francisco Bay, South Bay only	Throughout U.S. (this race endemic to south San Francisco Bay)	Nominated for rare, endangered species in Calif., nesting, abundant locally
Rufous-sided Towhee, *Pipilo erythrophthalmus*	Forest undergrowth, riparian thickets	Santa Clara County Planning, 1969; USDI, 1974	Throughout state, except higher mountain areas, southeast deserts	Throughout U.S.	Uncommon, nesting
Brown Towhee, *P. fuscus*	Brushlands, riparian thickets, urban	Santa Clara County Planning, 1969; USDI, 1974	Absent from extreme north, northeast, east, southeast, and western edge of San Joaquin Valley, widespread elsewhere	West and southwest U.S.	Uncommon, nesting
Sharp-tailed Sparrow, *Ammospiza caudacuta*	Marshes near coast	USDI, 1974	Coastal marshes	East of Rocky Mountains	Rare, winter and spring
Lark Sparrow, *Chondestes grammacus*	Open land; agricultural land with trees nearby	USDI, 1974	Length of state west of Sierra Nevada Mountains	Throughout U.S.	Rare, winter and spring
Dark-eyed Junco, *Junco hyemalis*	Open country	USDI, 1974	Length of state	Throughout U.S.	Occasional, nesting
Fox Sparrow, *Passerella iliaca*	Brush, undergrowth	USDI, 1974	Mountains south to Los Angeles area	Throughout U.S., except extreme southeast	Uncommon
Lincoln's Sparrow, *Melospiza lincolnii*	Meadows, thickets, undergrowth	USDI, 1974; Martineau, undated	Mountains of state	Throughout U.S., except extreme southeast	Uncommon
Swamp Sparrow, *M. georgiana*	Freshwater marshes	USDI, 1974	Coast	Eastern U.S.	Rare, winter

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REPTILES					
Lizards					
Western Fence Lizard, *Sceloporus occidentalis*	Lower Sonoran to lower Canadian Life Zones, woody and rocky areas	Santa Clara County Planning, 1969; Martineau, undated	Statewide, except desert	West of Rocky Mountains	
Alligator Lizard *Gerrhonotus* sp.		Martineau, undated	Depends on species	West of Rocky Mountains	
Snakes					
Gopher Snake, *Pituophis catenifer*	Lower Sonoran to Transition Life Zones, various habitats	Santa Clara County Planning, 1969; Martineau, undated	Statewide	Western U.S.	
Common King Snake, *Lampropeltis getulus*	Lower Sonoran to Transition Life zones, various habitats	Martineau, undated	Statewide	Southern U.S.	
AMPHIBIANS					
Frogs and Toads					
Western Toad, *Bufo boreas*	Lower Sonoran to Boreal Life Zones, various habitats	Martineau, undated	Statewide, except southeast deserts	Western U.S.	
Pacific Treefrog, *Hyla regilla*	Lower Sonoran to Boreal Life Zones, as much as half mile from water	Martineau, undated	Statewide, except southeast deserts	West of Rocky Mountains	
FISH (Sharks and Rays)					
Sevengill Shark, *Notorynchus maculatus*	Bays	Aplin, 1967	Coastal waters	Pacific Ocean	
Big Skate, *Raja binoculata*	Smooth bottoms, 10-360 feet	Aplin, 1967	Coastal waters	Pacific Ocean	Minor commercial importance San Francisco Bay
Leopard Shark, *Triakis semifasciata*	Bays, along beaches	Aplin, 1967; Santa Clara County Planning, 1969; Calif. Bus. and Transp., undated	Coastal waters	Pacific Ocean to Oregon	

Organism	Preferred Habitat (and seasonal status)[2]	Occurrance[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California[4]	Range and/or Relative Abundance in U.S.[5]	Comment[6]
Brown Smoothhound Shark, *Mustelus henlei*	Shallow waters to 2[illegible] feet	Aplin, 1967; Gill, 1973; Gill, 1972; Santa Clara County Planning, 1969	To Humboldt Bay from Mexico	Pacific Ocean to Humboldt Bay	
Spiny Dogfish Shark, *Squalus acanthas*	Cold water, inshore in winter, shallow waters to 1,200 feet	Aplin, 1967; Santa Clara County Planning, 1969	Coastal waters	Atlantic and Pacific Oceans	
Shovelnose Guitarfish, *Rhinobatos productus*	Shallow waters to 50 feet	Santa Clara County Planning, 1969	San Francisco Bay south	Pacific Ocean to San Francisco Bay	
Round Stingray, *Urolophus halieri*	Shallow waters to 70 feet	Santa Clara County Planning, 1969	Mexico to Humboldt	Pacific Ocean north to Humboldt Bay	
Bat Ray, *Myliobatis californica*	Shallow waters to 150 feet	Aplin, 1967; Santa Clara County Planning, 1969· Calif. Bus. and Transp., undated.	Coastal waters	Pacific Ocean north to Oregon	
FISH (Bony Fishes)					
White Sturgeon, *Acipenser transmontanus*	Salt and fresh waters	Santa Clara County Planning, 1969		Pacific Ocean	Anadromous
Green Sturgeon, *A, medirostris*	Salt and brackish waters, to 400 feet in depth in ocean	Santa Clara County Planning, 1969	Coastal waters	Pacific Ocean	
American Shad, *Alosa sapidissima*	To 600 feet	Aplin, 1967	Coastal waters	Atlantic and Pacific Oceans	Anadromous; introduced to Calif. in 1871
Threadfin Shad, *Dorosoma petenense*	Salt and fresh waters	Aplin, 1967; Martineau, undated	California freshwater lakes; Long Beach to Humboldt Bay south	Atlantic Ocean	Introduced
Steelhead, *Salmo gairdneri*		Aplin, 1967; Gill, 1973; Gill, 1972; Santa Clara County Planning, 1969	Coastal streams from Monterey north to Oregon		Anadromous sport species
Pacific Tomcod, *Microgadus proximus*	Surface to 720 feet	Aplin, 19[illegible]7; Calif. Bus. and Transp., undated	Coastal waters	Pacific Ocean	
Three-spined Stickleback, *Gasterosteus aculeatus*		Aplin, 1967; Gill, 1973; Gill, 1972; Ponds 1 and 2, Carpelan, 1957; Martineau, undated			

Organism	Preferred Habitat (and seasonal status)[2]	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California[4]	Range and/or Relative Abundance in U.S.[5]	Comment[6]
Striped Bass, *Morone saxatilis*	Coastal waters and freshwater bays, along beaches	Aplin, 1967; Gill, 1973; Gill, 1972; Santa Clara County Planning, 1969; Calif. Bus. and Transp., undated		Pacific and Atlantic Oceans	Anadromous; sport importance San Francisco Bay; introduced
Surf Perch, Shiner Perch, *Cymatogaster aggregata*	Surface to 480 feet	Aplin, 1967; Gill, 1973; Gill, 1972; Santa Clara Planning, 1969; Calif. Bus. and Transp., undated	Coastal waters	Pacific Ocean	Minor commercial and sport importance San Francisco Bay
Longjawed Mudsucker, *Gillichthys mirabilis*	Shallow areas of bays, mudflats	Gill, 1973; Gill, 1972; Santa Clara County Planning, 1969; Ponds 1, 2, and 3, Carpelan, 1957	Tomales Bay south	Pacific Ocean, Tomales Bay south	
Lingcod, *Ophiodon elongatus*	Post larvae, nearshore, offshore; juveniles, shallow bays, sand and mud bottoms, adults to 1,400 feet	Santa Clara County Planning, 1969	Coastal waters	Pacific Ocean	Minor commercial and sport importance San Francisco Bay
Staghorn Sculpin, *Leptocottus armatus*	Intertidal to 300 feet	Aplin, 1967; Gill, 1973; Ponds 1,2, and 3, Carpelan, 1957; Gill, 1972	Coastal waters	Pacific Ocean	
Topsmelt, *Atherina affinis*	Inshore and in bays	Aplin, 1967; Gill, 1973; Gill, 1972; Ponds 1, 2, 3, and 4, Carpelan, 1957.	Coastal waters	Pacific Ocean	Minor commercial importance San Francisco Bay
Diamond Turbot, *Hypsopsetta guttulata*	5 to 150 feet	Aplin, 1967; Santa Clara County Planning, 1969	North to Cape Mendocino	Pacific Ocean north to Cape Mendocino	Minor commercial importance San Francisco Bay
Starry Flounder, *Platichthys stellatus*	2 to 900 feet	Aplin, 1967; Gill, 1973, Gill, 1972; Santa Clara County Planning, 1969;	Coastal waters from Santa Barbara north	Pacific Ocean north of Santa Barbara	Minor commercial and sport importance San Francisco Bay
Northern Anchovy, *Engraulis mordax*		Aplin, 1967; Gill, 1973; Gill, 1972	Coastal waters	Pacific Ocean	Commercially important San Francisco Bay
Bay Goby, *Lepidogobius lepidus*	Shallow bays to 200 feet	Aplin, 1967	Coastal waters	Pacific Ocean	
Jack Smelt, *Atherinopsis californiensis*	Inshore and bays	Aplin, 1967; Gill, 1973; Gill, 1972	Coastal waters	Pacific Ocean north to Oregon	Minor commercial importance San Francisco Bay

Organism	Preferred Habitat (and seasonal status)[2]	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California[4]	Range and/or Relative Abundance in U.S.[5]	Comment[6]
Northern Midshipman, *Porichthys notatus*	Near surface to 1,000 feet	Aplin, 1967; Gill, 1973; Gill, 1972	Coastal waters	Pacific Ocean	
Night Smelt, *Spirinchus starksi*	Spawns in surf at night, surface to 420 feet	Aplin, 1967	Point Arguello north	Pacific Ocean from Point Arguello north	Minor commercial importance San Francisco Bay
Longfin Smelt, *S. thaleichthys*	Surface to 66 feet	Aplin, 1967	San Francisco Bay, Humboldt Bay, Eel River	Pacific Ocean north of San Francisco Bay	Anadromous
Whitebait Smelt, *Allosmerus elongatus*	Surface to 180 feet	Aplin, 1967	San Pedro north	Pacific Ocean north from San Pedro	
English Sole, *Parophrys vetulus*	60 to 1,000 feet	Aplin, 1967	Coastal waters	Pacific Ocean	Commercially important San Francisco Bay
Walleye Surfperch, *Hyperprosopon argenteum*	Surface to 60 feet	Aplin, 1967	Coastal waters	Pacific Ocean	Minor sport importance San Francisco Bay
Bay Pipefish, *Syngnathus griseolineatus*	Eelgrass beds of bays	Aplin, 1967	Coastal waters	Pacific Ocean	
Pile Perch, *Rhacochilus vacca*		Aplin, 1967		Pacific Ocean	Minor commercial and sport importance San Francisco Bay
Pacific [illegible]mpano, *Peprilus simillimus*		Aplin, 1967		Pacific Ocean	
Speckled Sanddab, *Citharichthys stigmaeus*	10 to 1,200 feet	Aplin, 1967	Coastal waters	Pacific Ocean	
California Tonguefish, *Symphurus atricauda*	5 to 276 feet	Aplin, 1967	North to Humboldt County	Pacific Ocean north to Humboldt County	
White Croaker, *Genyonemus lineatus*	Surface to 330 feet	Aplin, 1967	Coastal waters	Pacific Ocean	Minor commercial and sport importance, San Francisco Bay

Organism	Preferred Habitat (and seasonal status)[2]	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California[4]	Range and/or Relative Abundance in U.S.[5]	Comment[6]
Black Perch, *Embiotoca jacksoni*	Surface to 130 feet	Aplin, 1967	North to Fort Bragg	Pacific Ocean north to Fort Bragg	
Dwarf Perch, *Micrometrus minimus*	Tidepools to 30 feet	Aplin, 1967	North to Bodega Bay	Pacific Ocean north to Bodega Bay	
Brown Rockfish, *Sebastes auriculatus*	Shallow to 180 feet	Aplin, 1967	Coastal waters	Pacific Ocean	
King Salmon, *Oncorhynchus tshawytscha*		Aplin, 1967		Pacific Ocean	Anadromous, sport importance
White Seaperch, *Phanerodon furcatus*	Surface to 140 feet	Aplin, 1967	Coastal waters	Pacific Ocean	Minor commercial importance in San Francisco Bay
Showy Snailfish, *Liparis pulchellus*	Intertidal to 600 feet	Aplin, 1967	Monterey Bay north	Pacific Ocean north of Monterey Bay	
Bluespot Goby, *Coryphopterus nicholsi*	5 to 90 feet – juveniles reported in deep water	Aplin, 1967	Coastal waters	Pacific Ocean	
Japanese Goby, *Acathogobius flavimanus*	Shallow bays	Aplin, 1967; Gill, 1973; Gill, 1972	Elkhorn Slough to Tomales Bay	Pacific Ocean, central	Introduced
Sand Sole, *Psettichthys melanostictus*	5 to 27 feet	Aplin, 1967	Coastal waters	Pacific Ocean	
Pacific Herring, *Clupea harengus pallasi*	Open sea; in schools, inshore schooling, spawns in intertidal zone	Aplin, 1967; Gill, 1973, Gill, 1972	Coastal waters	Pacific Ocean	Minor commercial importance in San Francisco Bay
Pacific Sanddab, *Citharichthys sordidus*	30 to 1,800 feet	Gill, 1973; Gill, 1972	Coastal waters	Pacific Ocean	Minor commercial importance in San Francisco Bay

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Organism	Preferred Habitat (and seasonal status)$^{(2)}$	Occurrance$^{(3)}$ and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California$^{(4)}$	Range and/or Relative Abundance in U.S.$^{(5)}$	Comment$^{(6)}$
Rainbow Surfperch, *Hypsurus caryi*	Surface to 130 feet	Gill, 1973: Gill, 1972	North to Cape Mendocino	Pacific Ocean north to Cape Mendocino	Minor sport and commercial importance in San Francisco Bay
Largemouth Bass, *Micropterus salmoides*	Ponds, small lakes, oxbows, tolerant of turbidity	Gill, 1973; Gill, 1972			Introduced in San Francisco Bay in 1874
Black Crappie, *Pomoxis nigromaculatus*	Clear, quiet water with mud or sand bottoms and submerged vegetation	Gill, 1973; Gill, 1972			Introduced in San Francisco Bay in 1891
Bluegill, *Lepomis macrochirus*	Warm, weedy waters of bays, ponds, lakes	Gill, 1973; Gill, 1972			Introduced in 1891 to San Francisco Bay
Carp, *Cyprinus carpio*	Warm, shallow waters	Gill, 1973; Gill, 1972			Introduced from Asia 1872, 1877
Goldfish, *Carassius auratus*	Dense aquatic vegetation	Gill, 1973; Gill, 1972			Introduced from Asia
FISH (Lampreys and Hagfish)					
River Lamprey, *Lampetra ayresii*	Salt and freshwater	Aplin, 1967			
INVERTEBRATES					
Mollusca					
Mud Snail, *Nassarius obsoletus*	Heavy mud	Ponds 1 and 2, Carpelan, 1957; Coyote Creek, Aplin, 1967; Santa Clara County Planning, 1969; Calif. Bus. and Transp., undated.			Introduced from East Coast
N. mendicus		Aplin, 1967			
Eastern Soft-shelled Clam, *Mya arenaria*	Mudflats	Santa Clara County Planning, 1969; Calif. Bus. and Transp., undated	South to Monterey, most abundant in San Francisco Bay	Coasts of Washington, Oregon south to Monterey, Atlantic Coast	Introduced from East Coast

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Ribbed Mussel, *Modiolus demissa*		Santa Clara County Planning, 1969; Coyote Creek and mudflats, Aplin, 1967; Carpelan, 1957; Calif. Bus. and Transp., undated			
Thin-shelled Clam		Calif. Bus. and Transp., undated			
Bay Mussel, *Mytilus edulis*		Santa Clara County Planning, 1969; mudflats, Aplin, 1967	Coastal waters	Pacific Coast and Atlantic Coast	
Eastern Oyster, *Crassostrea virginica*		Santa Clara County Planning, 1969	San Francisco Bay, Tomales Bay	California, Washington; East Coast	Introduced
Catspaw Oyster		Santa Clara County Planning, 1969			
Channeled Whelk, *Busycon canaliculatum*	Sandy, shallow water	Santa Clara County Planning, 1969			
Pacific Oyster, *Crassostrea gigas*		Santa Clara County Planning, 1969; mudflats, Aplin, 1967			Introduced from Japan, 1938
Atlantic Drill, *Urosalpinx cinereus*		Santa Clara County Planning, 1969; Aplin, 1967	San Francisco to San Pedro	Atlantic Coast, California	Introduced from East Coast, preys on oysters
Japanese Littleneck Clam, *Tapes semidecussata*		Santa Clara County Planning, 1969; Aplin, 1967			
Bent Nose Clam, *Macoma nasuta*		Santa Clara County Planning, 1969			
Jacknife Clam, *Tagelus californianus*	Burrows	Santa Clara County Planning, 1969	Santa Barbara south	California coast	
Rough Piddock, *Zirfaea gabbi*	Burrows, hard clay of bay shores or ocean shore reefs	Santa Clara County Planning, 1969	Coast	Pacific Coast	

Organism	Preferred Habitat (and seasonal status)(2)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative Abundance in California(4)	Range and/or Relative Abundance in U.S.(5)	Comment(6)
Mud Mussel, *Musculus senhousei*		Aplin, 1967			
Gaper Clam *Schizothaerus nuttallii*	Fine mud, mudflats—outer beaches and muddy bays	Aplin, 1967	Pacific Coast	Pacific Coast	
Ocenebra sp.		Aplin, 1967			
Native Oyster, *Ostrea lurida*		Mudflats, Aplin, 1967; Carpelan, 1957	Coastal waters	Pacific Coast	
Basket Cockle		Mudflats, Aplin, 1967			
Arthropods (Aquatic)					
Brine shrimp, *Artemia salina*	Tolerant of high salt concentrations (2x to 5x seawater)	Pond 6, Carpelan, 1957			
Copepod, *Acartia tonsa*	Free swimming, offshore	Ponds 1, 2, and 3, Carpelan, 1957			
Copepod, *A. clausi*		Pond 3, Carpelan, 1957			
Copepod, *Eurytemora hirundoides*		Pond 3, Carpelan, 1957			
Copepod, *Pseudodiaptomus euryhalinus*	Salt tolerant — 1.8 to 68%	Pond 3, Carpelan, 1957			
Acorn barnacle, *Balanus glandula*	Between low and high tide marks on rocks, mussels, etc.	Coyote Creek, Aplin, 1967; Calif. Bus. and Transp., undated	South to southern California	Pacific Coast south to southern California	
Isopod, *Limnoria lignorum*	Pilings, gates of floodgate, wood boring	Pond 1, Carpelan, 1957	Northern California coast, cool water	Atlantic Coast, cooler portion of Pacific Coast	Damages wood pilings

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Isopod, *Sphaeroma pentodon*	Mud, also burrows in wood	Ponds 1 and 2, Carpelan, 1957	Coast	Pacific Coast	
Amphipod, *Corophium spinicorne*	Decomposing algae	Pond 2, Carpelan, 1957			
Amphipod, *Anisogammarus confervicolus*	Not tolerant of low oxygen; lives in macro-algae	Carpelan, 1957			
Rock crab, *Cancer antennarius*	Rocky shores, shallow water	Santa Clara County Planning, 1969	Coast	Pacific Coast	
Brackish-water Crab		Santa Clara County Planning, 1969			
Brackish-water Shrimp		Santa Clara County Planning, 1969			
Blue Mud Shrimp		Santa Clara County Planning, 1969			
Ghost Shrimp		Santa Clara County Planning, 1969			
Mud Crab, *Hemigrapsus oregonensis*	Mudflats	Aplin, 1967; Ponds 1, 2, and 3, Carpelan, 1957	Coast	Pacific Coast	
Shore Crab, *Pachygrapsus crassipes*	Rocks, sand, mudflats, and sloughs	Mudflats, Aplin, 1967	California coast	Oregon south	
Pugettia richii	Among seaweed or eelgrass near shore	Aplin, 1967	Coast	Pacific Coast	
Spider Crab, *Pyromaia tuberculata*		Aplin, 1967	North to Monterey Bay		

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Skeleton Shrimp, *Caprella* sp.	Masses of algae or hydroid colonies close to shore or in deep water	Mudflats, Aplin, 1967	(varies with species)	Pacific Coast	
Arthropods (Insects)					
Cabbage Butterfly, *Pieris rapae*		Santa Clara County Planning, 1969			Larva a pest on cabbage family plants
Tiger Swallowtail, *Papilio glaucus*	Larva feeds on trees and shrubs	Santa Clara County Planning, 1969			
Anise Swallowtail		Santa Clara County Planning, 1969			
Painted Lady, *Vanessa cardui*	Larva feeds on thistles	Santa Clara County Planning, 1969			
Sulphur		Santa Clara County Planning, 1963			Larvae of these species are pests on forage crops such as clover
Buckeye		Santa Clara County Planning, 1969			
Pygmy Blue		Santa Clara County Planning, 1969			
Salt Marsh Fly, *Ephydra millbrae*		Santa Clara County Planning, 1969; Ponds 1-6, Carpelan, 1957			
Salt Marsh Mosquito		Santa Clara County Planning, 1969			
Water Boatmen Beetles, *Trichocorixa reticulata*	Independent of dissolved oxygen (air breather) and impervious to hydrogen sulfide	Ponds 1-6, Carpelan, 1957			
Drone Fly, *Eristalis texax (larva)*		Ponds 1-6, Carpelan, 1957			

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Kelp Fly,	*Fucellia rufitibia*	Floating green algae	Ponds 1-6, Carpelan, 1957			
Annelids						
Polychaete,	*Marphysa sanguinea*		Aplin, 1967			
Polychaete	*Polydora ligni*		Ponds 1, 2, and 3, Carpelan, 1957			
Polychaete,	*Axiothella rubrocincta*	Sticky mud	Aplin, 1967			
Polychaete,	*Nereis zonata*	Sandy mud	Aplin, 1967			
Polychaete,	*N. succinea*	Sandy mud	Aplin, 1967			
Polychaete,	*N. procera*		Aplin, 1967			
Nemerteans	*Tubulanus sexlineatus*	Decomposing algae	Pond 1, Carpelan, 1957			
Rotifers	*Barchionus plicatilus (?)*		Ponds 2, 3, and 5, Carpelan, 1957			
Coelenterates	*Tubularia crocea*	Submerged piles, cool water	Pond 1, Carpelan, 1957	Coast	Atlantic and Pacific Coasts, cool water	
Anemone,	*Diadumene luciae*	Pilings, floating logs	Aplin, 1967; Ponds 1, 2, Carpelan, 1957			

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Sea Pen, *Stylatula elongata*	Mud of shallow bays	Santa Clara County Planning, 1969	San Francisco south to San Diego	California	
Porifera					
Wandering Sponge		Santa Clara County Planning, 1969			
Tetilla mutabilis		Aplin, 1967			
Bryozoa					
Membranipora sp.	Encrusting on "solid" objects—algal fronds, rockweed, etc.	Aplin, 1967	(varies with species)		

Table G-1 (update)
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Organism	Preferred Habitat (and seasonal[2] Status)	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative[4] Abundance in California	Range and/or Relative[5] Abundance in U.S.	Comment[6]
MAMMALS					
Pacific Shrew *Sorex pacificus*	Redwood and Spruce Forests, marshes swamps	Final EIS Acquisition of Land for San Francisco Bay National Wildlife Refuge (NWR) 1977	San Francisco Bay Area, North along the Pacific Coast	California, Pacific Coast Oregon	
Shrew – mole *Neurotrichus gibbsii*	Moist areas in shady ravines and along streams from level to 8000 ft.	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area, North along the Pacific Coast	California, Oregon, Washington Pacific Coastline	
Merrian Chipmunk *Eutamias merriamic*	Chaparral slopes, mixed oaks, digger pine forests streamside thickets, rock out crops, foothills	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area, and Southern Coastal Mountains and Sierra Foothills	California, Central Baja	
Western Gray Squirrel *scieurus griseus*	Oak and pine-oak forests, fairly open	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State, except central valley	California, Oregon, Central Washington	
California Packet Mouse *Perognathus californicus*	Chaparral or live-oaks	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Bay Area, Southern Coastal Mountains, Sierra Foothills	California, Central Baja	
California Mouse *Peromyscus californicus*	Chaparral or live-oaks	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area and South	California, Western Baja	
Deer Mouse *P. maniculatus*	Dry land	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Entire U.S.A. except Gulf interior States.	
Brush Mouse *P. boylii*	Chaparral, rocky situations	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	California, Southwestern U.S.A.	
Pinyon Mouse *P. Truei*	Rocky terrain, scattered pinon and junipers	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the state except in central valley	California, Southwestern U.S.A.	

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Table G-1 (Update)
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Dusky-footed Wood Rat *Neotoma* *fuscipes*	Heavy chaparral, streamside thickets deciduous or mixed woods	Final EIS Acquis. of land for S.F. Bay NWR, 1977	West of Sierras except for Central Valley	California, Central Oregon	
Muskrat *Ondatra* *zibethica*	Marshes, edge of ponds, lakes, streams cattails, rushes, open water	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S.	
Audubon Cottontails *Sylvilagus* *audubonii*	Open plains, foothills, low valleys grass, sagebrush, scattered pinons, junipers	Final EIS Acquis. for S.F. Bay NWR, 1977	San Francisco Bay Area South Central California	California, Western U.S.	
Coyote Canis *latrans*	Prairie, open wood lands, brushy or boulder-strewn areas	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S. except Eastern Seaboard	
Gray Fox *Urocyon* *cinereoargentus*	Chaparral, open forests, rimrock country	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S. except Northwestern States	
Badger *Taxidea* *taxus*	Open grasslands, deserts	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State, except Northwest corner	Central and Western U.S.	
Harbor Porpoise *Phocaena* *vomerina*		Final EIS Acquis. of land for S.F. Bay NWR, 1977		Pacific Coast	
Little Brown Myotis *Myotis* *lucifugus*	Caves, mines, hollow trees, buildings	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern California	Central and Northern U.S.	
Yuma Myotis *M.* *yumanensis*	Caves, tunnels, buildings	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western and South Western U.S.	
Long-eared Myotis *M.* *evotis*	Thinly forested areas, buildings, trees, occasionally caves	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western U.S.	

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Fringed Myotis *M. thysanodes*	Caves, attics of old buildings	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western U.S.	
Hairy-winged Myotis *M. udans*	Buildings, small pockets and crevices in rock ledges	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western U.S.	
California Myotis *M. californicus*	Mine tunnels, hollow trees, loose rocks, buildings, bridges	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western U.S.	
Western Pipistrelle *Pipistrellus hesperus*	Caves, loose rocks, crevices in cliffs, buildings, near watercourses	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State except Northwest corner	Southwestern U.S. and West Coast	
Big Brown Bat *Eptesicus fuscus*	Caves, tunnels, crevices, hollow trees, buildings, wooded areas	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S.	
Hoary Bat *Lasiurus cinereus*	Wooded areas	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S. except southern tip of Florida	
Lump-nosed Bat *Plecotus townsendii*	Caves, mines, tunnels, buildings	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Western U.S.	
Pallid Bat *Antrozous pallidus*	Caves, mine tunnels, crevices in rocks, building, trees	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Southwest and Western U.S.	
Brazilian Free Tailed Bat *Tadarida brasiliensis*	Caves, buildings	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Southwest U.S. and California	
BIRDS					
Leach's Petrel *Oceanodroma leucurhoa*	Open sea	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Pacific Coast	Pacific and Atlantic Ocean	Accidental

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BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

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Ashy Petrel *Oceanodrama homochroa*	Open sea	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Pacific Coast	Pacific Ocean	Accidental
Cattle Egret *Bubulcus ibis*	Pastures with cattle	Final EIS Acquis. of land for S.F. Bay N		Gulf States	Rare, fall, winter
Fulvous Tree Duck *Dendrocygina bicolor*	Marshlands	Final EIS Acquis. of land for S.F. Bay NWR, 1977	South of San Francisco Pacific Coast	Pacific Coastline south of San Francisco	Accidental
Red-shoulder Hawk *Buteo linsatus*	Riparian and desert oak forest	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Central Valley, coastal lowlands	California, Eastern U.S.	Accidental
Swainson's Hawk *Buteo swainsoni*	Grasslands, oak, woodlands, savannah	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Inland, throughout the State	Western U.S.	Accidental
Ruff *Philomachus pugnax*	Mud flat, margin & sloughs and ponds	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Pacific Coast	North East and West Coasts	Accidental
Pomarine Jaeger *Stercorarius pomarinus*	Open ocean	Final EIS Acquis. of land for S.F. Bay NWR, 1977	California Coast	Atlantic and Pacific Ocean	Accidental, summer
Black-legged Kittiwake *Rissa tridactyla*	Open ocean, sea coast	Final EIS Acquis. of land for S.F. Bay NWR, 1977	California Coast	Atlantic and Pacific Ocean	Rare, winter
Sage Thrasher *Oreoscoptes mountanus*	Flat areas with sagebrush	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area and South	Western U.S.	Accidental
Mountain Bluebird *Sialia currucades*	Sub-alpine forests	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	West of Mississippi River	Accidental

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
Northern Shrike *Lanius excubitor*	Open country, scattered trees	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Not normally found	North Western U.S.	Accidental
Red-eye Vireo *Vireo olivaceus*	Eastern deciduous forest	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Nor normally found	Throughout the U.S. except Western States	Accidental
Yellow Warbler *Dendroica petechia*	Willow thickets, orchards, suburban shrubbery	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State	Throughout the U.S.	Uncommon, spring, summer, fall
Brewers Sparrows *Spizella breweri*	Brushland, sage	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Southern California desert	Western Arid U.S.	Accidental
White-throated Sparrow *Zonotrichia albicollis*	Dense undergrowth and brush	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastline	California Coastline and Eastern U.S.	Accidental
REPTILES					
Coast Horned Lizard *Phrywosoma coronatum*	Open dry space, light plant cover	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Central and Western California	Kansas to So. Arizona, Central and Western California introduced in other states	
Western Skink *Eumeces skiltonianus*	Under logs, rocks in woodland, forest, grassland	Final EIS Acquis of land for S.F. Bay NWR, 1977	Western part of State	California, Pacific Northwest	
Western Whiptail *Cnemidaphorus tigris*	Dry, sandy regions, gravelling arroyos or washes in rocky areas	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout state except North West corner	Western U.S.	
Rubber Boa *Charina bottae*	Damp sands near streams coniferous woods	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern California except Central Valley	Pacific and Western U.S.	
Ringneck Snake *Diadophis amabilis*	Yellow pine and black-oak forests	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal hills and Sierra Foothills	West Coast to Oregon/ Washington border	

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Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
Sharp-tailed Snake *Contia tenuis*	Beneath digger pines, blue oak, mazanita, chamise	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern California except central valley	Northern California	
Racer *Coluber constructor*	Open country or breaks in forest areas	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern and Western California	Throughout U.S. except in Southeastern California	
Coachwhip *Masticophis flagellum*	Open field, grasslands,	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area South	South half of U.S.	
Striped Racer *M. lateralis*	Thick brush, coast or live oak, open brushy area with patches of grassland	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal hills and Sierra Foothills	California	
Western Gartersnake *Thamnophis elegans*	Sea level to high elevations	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State except southeast California	Western U.S.	
Common Gartersnake *T. sirtalis*	Meadows, marshes, ponds,	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Throughout the State except southern desert	Throughout the U.S. except in the western desert.	
Western Rattlesnake *Crotalus viridis*	Chaperral, grassland, prairies	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coast and Northern California	Western U.S.	
AMPHIBIANS					
Tiger Salamander *Ambystoma tigrnum*	Burrows, vicinity of lakes, ponds, streams	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area South along coast to Santa Barbara	Coast of California, Central U.S. and Eastern Seaboard	
Pacific Giant Salamander *Dicamptodon ensatus*	Water, land, under logs, bark, other objects	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area, North along the Coast and Interior Mountains	Western California, Oregon, Washington	

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
California Newt *Taricha torosa*	Streams, canyons,	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal and Sierra Foothills	California	
Rough-skinned newt *T. granulosa*	Humid coastal forests, grasslands near lakes, ponds, streams or reservoirs	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area and North Western California	Western Oregon, Washington and Northern California	
Ensatina *Ensatina eschscholtzi*	Maple forests, redwood forests, chaparral, live-oak forests	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal Mountains, Sierra Foothills North Western California	Western Oregon, Washington and California	
California Slender Salamander *Batrachoseps attenuatus*	Maple forests, red wood forests, chaparral, live-oak forests	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal Mountains and San Joaquin Valley	California	
Arboreal Salamander *Aneides lugubris*	Coast live oak, black oak, found under logs, bark, boards, rocks, burrows, crevices, cavities	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal Mountains	California	
Western Spadefoot *Scaphiopus hammondi*	Short grass hills, plains, alkaline flats, semiarid and arid regions	Final EIS Acquis. of land for S.F. Bay NWR. 1977	Coastal Mountains	California Coastal Mountains and Western Desert	
Red-legged Frog *Rana aurora*	Quiet ponds, pools, streams, reservoirs, springs, lakes, and marshes	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern California Coastal Mountains, Sierra Foothills	California, Western Oregon and Washington	
Yellow-legged Frog *R. boylei*	Near water, high mountain lakes,	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Northern California, Coastal Mountains, Sierra Foothills	California and Southwestern Oregon	
Bullfrog *R. catesbeiana*	Ponds, reservoirs, streams, marshes	Final EIS Acquis. of land for S.F. Bay NWR, 1977	San Francisco Bay Area, San Joaquin Valley, Southern California Basin	East of Rockies, sparsely population throughout the West	Introduced West of Rockies

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
FISH (Shars and Rays)					
Six Gill Cowshark *Hexanchus* *griseum*	Shallow bays to 950 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Soupfin Shark *Galeorhinus* *zyopterus*	Epipelagic	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
California Skate *Raja* *inornata*	60 ft waters to 2,200 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
FISH (Bony Fishes)					
Pacific Sardine *Sardinops* *caeruleus*	Epipelogic	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Chum Salmon *Oncorhynchus* *keta*	Anadromous	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Del Mar to Arctic, Alaska	Rare
Pink Salmon *O.* *gorbuscha*	Anadromous	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	La Jolla to Arctic, Alaska	Rare
Silver Salmon *O.* *keta*	Anadromous	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Red (sockeye) Salmon *O.* *nerka*	Anadromous	East Bay Dischargers Authority (DEIS) 1975	Sacramento River System North	North Coastal Waters of Pacific Ocean	
Surf Smelt *Hypomesus* *pretiosus*		Final EIS Acquis. of land for S.F. Bay NWR, 1977	Long Beach Northward	Long Beach to Alaska	

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY[1]

Organism	Preferred Habitat (and seasonal[2] Status)	Occurrence[3] and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative[4] Abundance in California	Range and/or Relative[5] Abundance in U.S.	Comment[6]
Pacific Hake *Merluccius productus*	Near survace to 3,000 ft.	East Bay Dischargers Authority (DEIS) 1975	Gulf of California Northward	Gulf of California North to Alaska	
Black & Yellow Rockfish *Sebastes chrysomelas*	Intertidal to 120 ft.	East Bay Dischargers Authority (DEIS) 1975	California/Mexico border to Eureka	California Coastal Waters	
Black Rockfish *S. melanops*	Surface to 300 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Blue Rockfish *S. mystinus*	Surface to 300 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Yellowtail Rockfish *S. flavidus*	Surface to 900 ft.	East Bay Dischargers Authority (DEIS) 1975	San Diego North	Pacific Ocean north to Alaska	
Widow Rockfish *S. entomelas*	Near surface to 1050 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Green Striped Rockfish *S. elongatus*	Depth 200 to 1320 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Bocaccio *S. pancispinis*	Surface to 1050 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Chillipepper *S. goodei*	Surface to 1080 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
Splitnose Rockfish *S. diploproa*	Depth 700 ft. to 1560 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Vermilion Rockfish *S. miniatus*	Shallow water to 660 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Washington	
Orange (canary) Rockfish *S. pinniger*	Surface to 900 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Sable Fish *Anoplopoma fimbria*	Surface to 5,000 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Cabezon *Scorpaenichthys marmoratus*	Intertidal to 250 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
White Sea-bass *Cynoscion nobilis*		East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	Uncommon north of San Francisco
Rubberlip Surfperch *Rhacochilus toxotes*	Surface to 150 ft.	East Bay Dischargers Authority (DEIS) 1975	Baja California to Russian Gulf State Beach, Mendocino, Ca.	California Coastal Waters	
Barred Surfperch *Amphistichus argenteus*	Surface to 240 ft.	East Bay Dischargers Authority (DEIS) 1975	Baja California north to Bodega Bay	California Coastal Waters	
Calico Surfperch *A. koelzi*	Surface to 30 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Washington	

Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
Redtail Surfperch *A. rhodoterus*	Surface to 24 ft.	East Bay Dischargers Authority (DEIS) 1975	Monterey Bay, North	Monterey Bay north to Washington	
Silver Surfperch *Hyperprosopon argenteum*	Surface to 60 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Washington	
Striped Surfperch *Embiotoca lateralis*	Surface to 55 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Reef Surfperch *Micrometrus aurora*	Intertidal to 20 ft.	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Baja California, north to Tomales Bay	Pacific Ocean to Tomales Bay	
Cheekspot Goby *Ilypnus gilberti*	Mudflats of bays	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Gulf of California to Walker Cr., Tomales Bay	Pacific Ocean to Tomales Bay	
Arrow Goby *Clevelandia ios*	Shallow areas of bays	Final EIS Acquis. of land for S.F. Bay NWR, 1977	Coastal Waters	Pacific Ocean north to Washington	
Albacore *Thunnus alalunga*	Epipelogic	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean	Worldwide on warm seas
California Halibut *Paralichthys californicus*	Surface to 300 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Pacific Halibut *Hippoglossus stenolepis*	Depth 20 to 3,600 ft.	East Bay Dischargers Authority (DEIS) 1975	Santa Rosa Is. north	Pacific Ocean north of Santa Rosa Is.	

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Table G-1 (Update)
BIOLOGICAL INVENTORY OF SOUTH SAN FRANCISCO BAY(1)

Organism	Preferred Habitat (and seasonal(2) Status)	Occurrence(3) and Reference Source(s) for Region of Proposed Conveyance	Range and/or Relative(4) Abundance in California	Range and/or Relative(5) Abundance in U.S.	Comment(6)
Curlfin Turbot *Pleuronichthys decurrens*	Depth 100 to 450 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean north to Alaska	
Rex Sole *Glyptocephalus zachirus*	Depth 60 to 2,100 ft.	East Bay Dischargers Authority (DEIS) 1975	San Diego Trough-North	Pacific Ocean north to Alaska	
Dover Sole *Microstomus pacificus*	Depth 90 to 3,000 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean	
Petrale Sole *Eopsetta jordani*	Depth 60 to 1,500 ft.	East Bay Dischargers Authority (DEIS) 1975	Coastal Waters	Pacific Ocean	
Pacific Lamprey *Lampetra tridentata*	Anadromous	East Bay Discharger Authority (DEIS) 1975	Coastal Waters	Pacific Ocean	
INVERTEBRATE MOLLUSCS					
Limpet *Acmaea Spp..*	Tide pools, shallow water rocks	East Bay Discharger Authority (DEIS) 1975	Coastal Waters	Pacific Ocean	

Notes (Table G-1):

(1) Based on literature survey.

(2) Habitat description taken from following sources:

Plants: California Business and Transportation, undated; Carpelan, 1957; Dana, 1963; Ferris, 1968; Ferris, 1970; Hotchkiss, 1972; City of Palo Alto, undated; Peterson and McKenny, 1968; Petrides, 1972; Robbins et al., undated; Sharsmith, 1970; Watts, 1973; USDA, 1971.
Mammals: Burt and Grossenheider, 1964.
Birds: Small, 1974.
Reptiles and Amphibians: Stebbins, 1954.
Fish: American Fisheries Society, 1970; Collins, 1959; Johnson and Snook, 1967.

(3) Regional occurrence as documented by literature on the biology of South San Francisco Bay. Unless specific locations identified with reference, distribution is throughout the study area in suitable habitat.

(4) California ranges from the following sources:

Plants: Ferris, 1970; Munz, 1964; Munz, 1972; Robbins et al., undated; Watts, 1973; USDA, 1971.
Mammals: Burt and Grossenheider, 1964.
Birds: Small, 1974.
Reptiles and Amphibians: Stebbins, 1954.
Fish: Miller and Lea, 1972.
Invertebrates: Johnson and Snook, 1967; Alpin, 1967.

(5) United States ranges from the following sources:

Plants: Ferris, 1970; Hotchkiss, 1972; Jaques, 1959; Munz, 1964; Peterson and McKenny, 1968; Petrides, 1972; Robbins et al., undated; USDA, 1971.
Mammals: Burt and Grossenheider, 1964.
Birds: Robbins, Bruun, and Zim, 1966.
Reptiles and Amphibians: Stebbins, 1954.
Fish: American Fisheries Society, 1970; Miller and Lea, 1972.
Invertebrates: Johnson and Snook, 1967.

(6) Includes notations on seasonal status, endangered species, introduced species, and pest species:

Plants: Brockman, 1968; California Business and Transportation, undated; Dana, 1963; DMJM/Hawley and Peterson, 1973; Jaques, 1959; Munz, 1964; Robbins et al., undated; Santa Clara County Planning, 1969.
Mammals: California Business and Transportation, undated.
Birds: USDI, 1974.
Fish: Miller and Lea, 1972; Skinner, 1962.
Invertebrates: Aplin, 1967; Carpelan, 1957; Johnson and Snook, 1967.

(7) Blank space indicates that no information is available.

REFERENCES FOR APPENDIX G

American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 3rd edition, American Fisheries Society Publication No. 6, Washington, D.C., 150 pages, 1970.

Anderson, W., "The California Least Tern Breeding in Alameda and San Mateo Counties," California Fish and Game, pp. 136-137, undated.

Aplin, J.A., Biological Survey of San Francisco Bay 1963-1964, prepared for California Department of Fish and Game by Marine Resources Operation Laboratory of Menlo Park, 131 pages, 1967.

Brockman, C.F., Trees of North America, Golden Press, New York, 280 pages, 1968.

Burt, W.H. and R.P. Grossenheider, A Field Guide to the Mammals, Houghton Mifflin Co., Boston, 284 pages, 1964.

California Business and Transportation Agency, Division of Bay Toll Crossings, Draft Environmental Impact Statement Dumbarton Bridge Replacement Project, undated.

Carpelan, L.H., "Hydrobiology of the Alviso Salt Ponds," Ecology, 38(3): pp. 375-390, 1957.

Collins, H.H., Jr., Complete Field Guide to American Wildlife, Harper and Row, New York, 683 pages, 1959.

Dana, W.S., How to Know the Wildflowers, revised by C.J. Hylander, Dover Publications, Inc., New York, 418 pages, 1963.

DMJM/Hawley and Peterson, Santa Clara County Arena Site Selection, Environmental Impact Studies, Palo Alto, California, 133 pages and appendices, 1973.

Ferris, R.S., Native Shrubs of the San Francisco Bay Region, University of California Press, Berkeley, 82 pages, 1968.

Ferris, R.S., Flowers of Point Reyes National Seashore, University of California Press, Berkeley, 119 pages, 1970.

Freeman, J., California Steelhead Fishing, Chronicle Books, San Francisco, 96 pages, 1971.

Gill, R., Jr., South San Francisco Bay Breeding Bird Survey, 1971, State of California Department of Fish and Game, Wildlife Management Branch, Report 72-6, 68 pages, 1972a.

Gill, R., Jr., Review of the Bi-monthly Bird Counts of San Francisco Bay, February 1964-December 1965, State of California Department of Fish and Game, Wildlife Management Branch, Report 72-8, 1972b.

Gill, R., Jr., The Breeding Birds of the South San Francisco Estuary, thesis presented in partial fulfillment of the Master of Arts Degree, California State University, San Jose, 145 pages, 1973.

Hotchkiss, N., Common Marsh, Underwater and Floating-leaved Plants of the United States and Canada, Dover Publications, Inc., New York, 223 pages, 1972.

Jaques, H.E., How to Know the Weeds, Wm.C. Brown Co., Dubuque, Iowa, 230 pages, 1959.

Johnson, M.E. and H.J. Snook, Seashore Animals of the Pacific Coast, Dover Publications, Inc., New York, 659 pages, 1967.

Martineau, R.T., "A Reconnaissance of Selected Biotic and Physical Aspects of the Palo Alto Flood Basin," prepared for the City of Palo Alto, Department of Nature and Science, mimeographed, 25 pages, undated.

Miller, D.J. and R.N. Lea, Guide to the Coastal Marine Fishes of California, California Department of Fish and Game Fish Bulletin 157, 235 pages, 1972.

Munz, P.A., Shore Wildflowers of California, Oregon, and Washington, University of California Press, Berkeley, 122 pages, 1964.

Munz, P.A., California Spring Wildflowers from the Base of the Sierra Nevada and Southern Mountains to the Sea, University of California Press, Berkeley, 122 pages, 1972.

City of Palo Alto, Nature and Science Staff, "Ecological Aspects of the ITT Baylands Property," mimeographed, 4 pages, undated.

Peterson, R.T. and M. McKenny, A Field Guide to Wildflowers of Northeastern and North-central North America, Houghton Mifflin Co., Boston, 420 pages, 1968.

Petrides, G.A., A Field Guide to Trees and Shrubs, Houghton Mifflin Co., Boston, 428 pages, 1972.

Robbins, C.G., B. Bruun, and H.S. Zim, A Guide to Field Identification — Birds of North America, Golden Press, New York, 340 pages, 1966.

Robbins, W.W., M.K. Bellue, and W.S. Ball, Weeds of California, State of California Documents and Publications, Sacramento, 547 pages, undated.

Santa Clara County Planning Department, A National Wildlife Refuge for San Francisco Bay, map, 1969.

Schaub, D.B., Salt-marsh Harvest Mouse Survey, State of California Department of Fish and Game, 1971.

Sharsmith, H.K., Spring Wildflowers of the San Francisco Bay Region, University of California Press, Berkeley, 1972, 192 pages, 1970.

Skinner, J.E., An Historical Review of the Fish and Wildlife Resources of the San Francisco Bay Area, State of California Department of Fish and Game, No. 1, 226 pages, 1962.

Small, A., The Birds of California, Winchester Press, New York, 310 pages, 1974.

Stebbins, R.C., Amphibians and Reptiles of Western North America, McGraw-Hill Book Co., Inc., New York, 536 pages, 1954.

Wandolleck, (in press, title unknown), 1974.

Watts, T., Pacific Coast Tree Finder, Nature Study Guild Publishers, Berkeley, California, 62 pages, 1973.

United States Department of Agriculture, Common Weeds of the United States, Dover Publications, Inc., New York, 463 pages, 1971.

United States Department of Interior, Fish and Wildlife Service, "Birds of the San Francisco Bay National Wildlife Refuge," pamphlet, 16 pages, 1974.

Appendix H

BENTHIC BIOLOGICAL SURVEY AND WATER QUALITY PROGRAMS

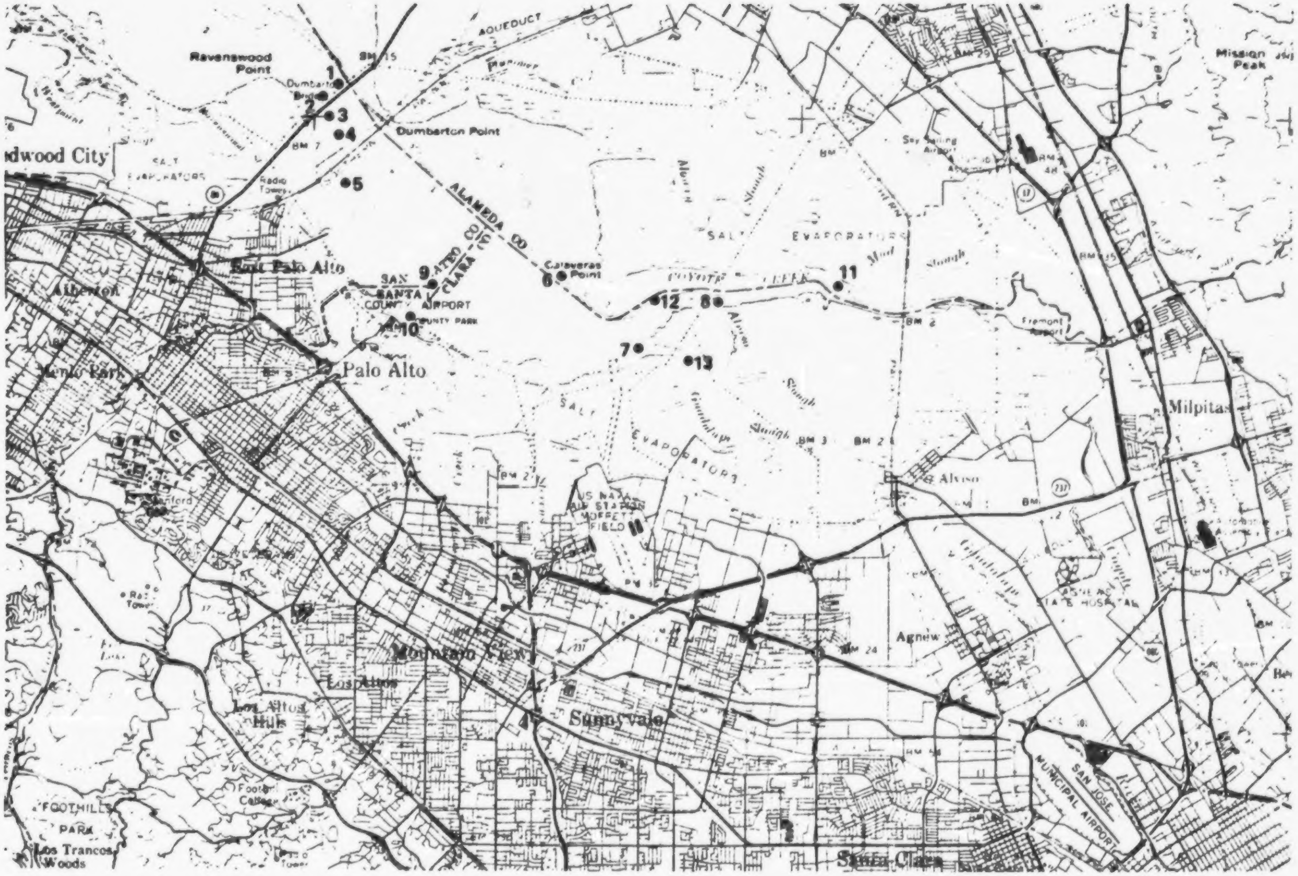
AQUEDUCT
Ravenswood Point
Dumbarton Point
Mission Peak
1
3
4
5
6
7
8
9
10
11
12
13
SALT EVAPORATORS
ALAMEDA CO
SAN MATEO CO
SANTA CLARA CO
Calaveras Point
COYOTE CREEK
Mud Slough
Alviso Slough
Guadalupe Slough
East Palo Alto
Atherton
Menlo Park
Palo Alto
Stanford
Mountain View
Sunnyvale
Los Altos
Los Altos Hills
FOOTHILLS PARK
Los Trancos Woods
Foothill College
US NAVAL AIR STATION MOFFETT FIELD
Fremont Airport
Milpitas
Alviso
Agnew
SAN JOSE MUNICIPAL AIRPORT
Santa Clara

Figure H-1
BENTHIC SURVEY
OCTOBER 1975 - AUGUST 1976

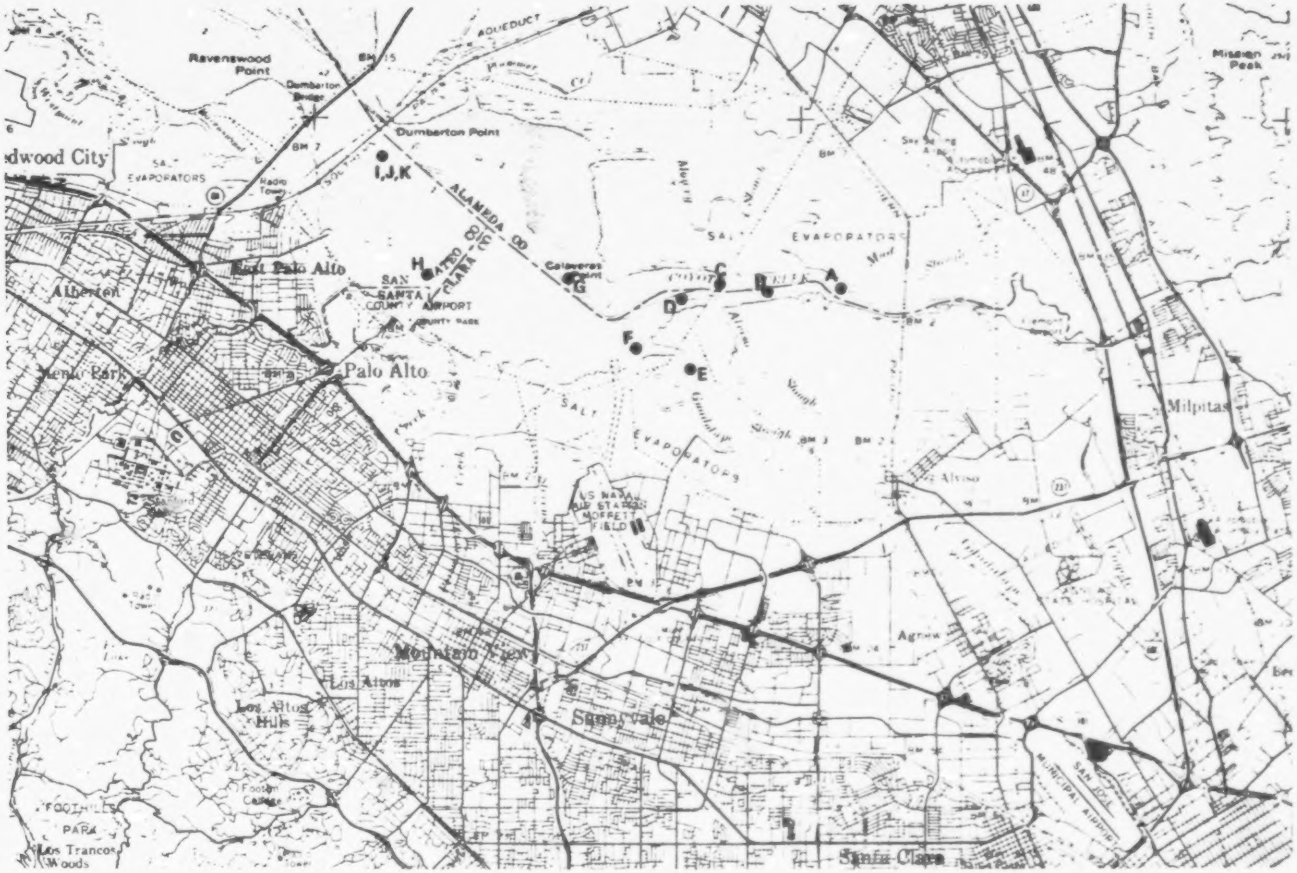
Ravenswood Point
Dumbarton Bridge
Dumbarton Point
AQUEDUCT
Redwood City
SALT EVAPORATORS
I,J,K
ALAMEDA CO
SANTA CLARA CO
SAN MATEO CO
H
East Palo Alto
Atherton
SANTA CLARA COUNTY AIRPORT
Calaveras Point
G
C
B
A
D
F
E
Palo Alto
Menlo Park
SALT EVAPORATORS
Mission Peak
Milpitas
Alviso
US NAVAL AIR STATION MOFFETT FIELD
Agnew
Mountain View
Los Altos
Los Altos Hills
Sunnyvale
Foothill College
FOOTHILLS PARK
Los Trancos Woods
Santa Clara
SAN JOSE MUNICIPAL AIRPORT

Figure H-2
WATER QUALITY SURVEY
OCTOBER 1975 - AUGUST 1976

H 1. BENTHIC SURVEY AND WATER QUALITY PROGRAM

BIONOMICS CORPORATION

NOVEMBER, 1975

PROGRESS REPORT
ON THE
SOUTH BAY DISCHARGERS
AUTHORITY
WASTEWATER DISPOSAL PROJECT

Benthic Survey and Water Quality
Sampling Program

Submitted to
Environmental Services Section
Bechtel

Prepared by

Bionomics Corporation
4090 Harrison Grade Road
Sebastopol, California 95472

November 1975

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SOUTH BAY DISCHARGER AUTHORITY
BENTHIC AND WATER QUALITY SAMPLING

I. Introduction

A brief review of the approved scope of work for this project is presented in order to clarify the procedures and objectives of the study. A baseline study of the benthic community in the South Bay is underway. The objectives of the study are to:

A. Describe seasonal changes in the population biology of major species of infaunal and epifaunal invertebrates. The variables to be measured include abundance, size and/or age distribution, fecundity, and recruitment.

B. Larger samples will be obtained for the purpose of determining the species composition of the less numerous, deeper burrowing forms.

A preliminary sampling survey has been conducted in the South Bay area to: (1) familiarize the investigators with the fauna, substrata and other biological variables; (2) test the different sampling equipment particularly with respect to faunal sampling characteristics in areas of major interest and evaluation of sampling techniques with respect to precision of estimation of abundances; (3) assess biological characterization of sampling areas and to establish permanent sampling stations which best represent the objectives of the study.

The first objective described above is the major objective of the study. This data can be obtained from a suitably designed sampling program. Estimates of the variables have been made using appropriate statistical sampling designs and procedures. The data obtained will provide information that will describe seasonally varying population characteristics. Changes in characteristic population biology will be detectable from comparisons of the aggregate population variables from one sampling period to another. The objective of the study is not to provide inclusive information on all the species present. This is rarely practical. The study will concentrate on species with aggregate sampling and estimation properties (of the variables mentioned) which will permit the most exact estimation of relevant aspects of their ecology.

It should be emphasized that none of the aforementioned estimates can be categorically obtained from some standard size of sample or sampling devices. The estimation of simple standard errors of means of abundances of organisms depends upon their underlying distribution in space, and under different conditions, fewer or more, smaller or larger sample quadrats or grab sizes can have similar estimation properties. The issue is to provide errors of estimates which can then be used to determine if statistically significant changes have occurred. Indeed, different sized sampling devices can be used at different times and still provide the requisite test of significance. If, however, only a small number of specimens are obtained in a sample designed for estimating abundance, but more are needed to estimate fecundity, size distribution or some other variable property, then either more samples or larger sample sizes would have to be taken simply to get enough specimens for observation. The objectives of the preliminary sampling stage of the study has been to obtain data permitting evaluation of alternate sampling procedures. This evaluation has taken into account the biological and sampling properties of individual species chosen for emphasis in the study.

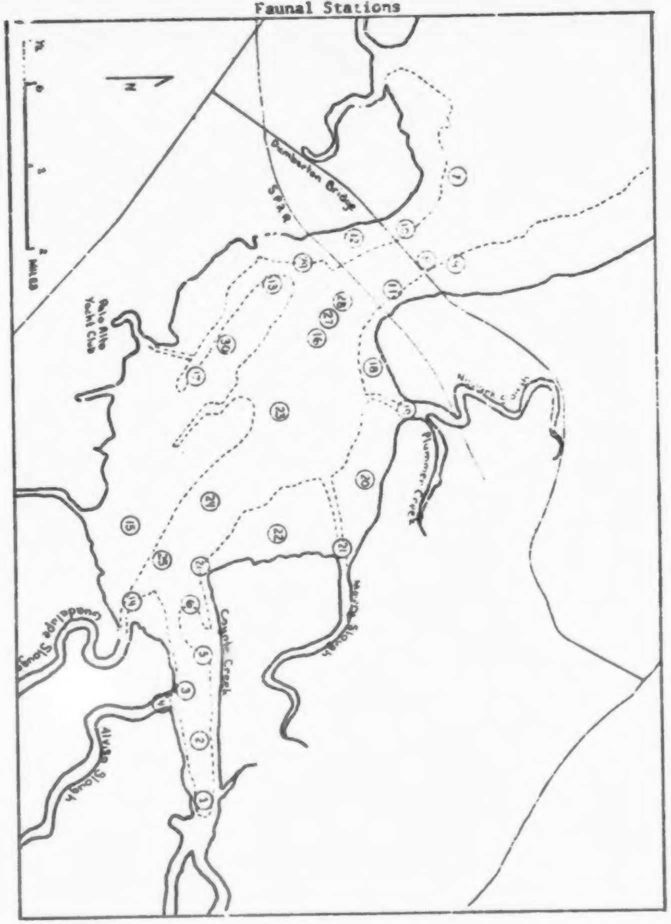
II. Methods and Materials

Thirty faunal stations were established in the South San Francisco Bay area (Fig. 1). Four replicate samples were taken at each station for a total of 120 faunal samples. The location of each faunal station was established by sextant triangulation using large and easily visable, permanent landmarks (Table I).

The vessel, a 17 ft. Boston Whaler, was anchored for each station and four replicate samples were taken using a Ponar grab. The volume of the grab is 0.0055 $m^3 \pm 0.00025\ m^3$ with a surface area of 0.0504 m^2. This grab was selected because a larger volume, heavier grab would be very difficult to handle safely in shallow water from a small vessel. The grab was manipulated by a crane and a 12 volt battery-powered winch attached to the bow of the boat. Each sample was carefully placed into a plastic container and the volume measured with a calibrated ruler.

Sieving was done on-board employing two sieve sizes, 1.0 and 0.5 mm. The stacked sieves were suspended over the side

Fig. 1
Faunal Stations


N
0
1
2
MILES
Dumbarton Bridge
Palo Alto Yacht Club
Plummer Creek
Coyote Creek
Mowry Slough
Alviso Slough
Guadalupe Slough
1
2
3
5
7
11
12
13
15
16
17
18
20
21
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23
24
27
28
29
30

Table I

Benthic Faunal Stations

Sta. #	Depth	Vol.-1	Time	Location
1A	3.05 m	3.50	12:00	50 yards south of platform in Coyote Creek.
B	"	5.00		
C	"	5.25		
D	"	5.50		
2A	3.05 m	2.80	12:45	Center of Coyote Creek, one-half way between electrical towers and platform, in line with small square marker on north side of creek.
B	"	2.50		
C	"	2.00		
D	"	2.80		
3A	2.44 m	4.00	13:30	Third tower south in Coyote Creek, near mouth of Alviso Slough.
B	"	5.00		
C	"	5.00		
D	"	5.50		
4A	2.59 m	3.90	17:00	Ten yards west of pumphouse in mouth of Alviso Slough.
B	"	4.80		
C	"	5.00		
D	"			
5A	0.91 m	5.25	17:30	In Coyote Creek, in line with the second tower in Coyote Creek and the Zeppelin hangar at Moffet Field.
B	"	4.00		
C	"	3.50		
D				
6A	1.68 m	3.25	18.20	In line with marker R20, second electrical tower in Coyote Creek, and the tall towers in Guadalupe Slough.
B	"	3.00		
C	"			
D	"	3.00		
7A	9.45 m	4.90	08:40	One hundred yards in channel from marker R14, north of car bridge.
B	"	2.50		
C	"	0.70		
D	"	2.50		
8A	11.89 m		09:30	North of car bridge in channel; 18° from first and second set of electrical towers on east side and 10° from center of bridge to electrical tower and first tower on west side of bridge.
B	"	1.75		
C	"	3.00		
D	"	4.75		
9A	0.91 m	3.00	10:30	North of car bridge, east side. In line with KGO radio towers and first electrical tower on east side of bridge.
B	"	2.75		
C	"	3.00		
D	"	3.50		
10A	0.91 m	4.90	11:10	In line with electrical towers on east side and second trestle on RxR bridge on east side, 26° to second electrical tower on east side of RxR bridge center and center of car bridge.
B	"	3.00		
C	"	2.40		
D	"	4.90		
11A	0.91 m	4.40	11:45	North of car bridge, in line with R14 marker and center of KGO radio towers.
B	"	1.90		
C	"	4.00		
D	"	2.50		

Table I cont.

Sta. #	Depth	Vol.-1	Time	Location
12A	0.91 m	2.50	13:20	50° between large electrical tower west of car bridge center and electrical tower at east shore where bridge ends, and 12° between center of RxR bridge and Aqueduct building.
B	"	3.50		
C	"	3.60		
D	"	3.00		
13A	2.13 m	2.50	14:05	Mayfield Slough. Next to orange buoy "G".
B	"	2.00		
C	"	4.00		
D	"	2.20		
14A	3.66 m	4.50	14:50	Marker R14 in Guadalupe Slough.
B	"	3.50		
C	"	3.00		
D	"	2.50		
15A	0.91 m	5.25	15:40	In line with third electrical tower in Coyote Creek and large hangars at Moffet Field.
B	"	5.00		
C	"	3.00		
D	"	5.00		
16A	7.32 m	4.80	16:15	In line with center of RxR bridge and orange buoy "G". Center of channel.
B	"			
C	"	4.00		
D	"	4.40		
17A	2.13 m		17:00	50 yards north of bird cage buoy.
B	"	2.70		
C	"	3.00		
D	"			

Table I cont.

Sta. #	Depth	Vol.-1	Time	Location
18A	1.52 m	4.90	09:10	40° to salt flats, 330° to KGO radio towers.
B	"	4.90		
C	"	4.20		
D	"	5.50		
19A	0.91 m	3.40	09:25	60° to salt flats, 300° to KGO radio towers.
B	"	4.00		
C	"	5.00		
D	"	5.00		
20A	0.91 m	3.40	09:55	30° to salt flats and 150° to Moffet field hangars.
B	"	4.40		
C	"	4.30		
D	"	5.40		
21A	1.52 m	4.90	10:20	170° to salt flats and 135° to Moffet Field. In Mowry Slough.
B	"	4.40		
C	"	5.40		
D	"	5.40		
22A	1.52 m	3.40	10:45	180° to salt flats and 270° to Moffet field.
B	"	3.40		
C	"	3.90		
D	"	5.30		
23A	6.09 m	3.00	11:15	Marker R17 in channel, 30° to salt flats and 160° to Moffet Field.
B	"	2.90		
C	"	1.60		
D	"	2.50		

Table I cont.

Sta. #	Depth	Vol.-1	Time	Location
24A	7.62 m	2.00	11:40	Channel marker R18
B	"	2.10		
C	"	1.00		
D	"	2.20		
25A	3.66 m	4.00	12:45	Channel marker R19.
B	"	4.10		
C	"	5.50		
D	"	4.00		
26A	2.13 m	3.60	13:05	150° to Moffet Field, 310° to Calaveras Point.
B	"	4.00		
C	"	3.00		
D	"	4.10		
27A	2.74 m	2.00	13:40	130° to Moffet Field, 270° to salt flats.
B	"	2.10		
C	"	2.20		
D	"	2.10		
28A	14.94 m	4.10	14:00	280° to center of RxR bridge, 200 yards southeast of center of RxR bridge, 120° to Moffet Field.
B	"	3.40		
C	"	4.10		
D	"	4.10		
29A	3.35 m	5.50	14:20	100 yards southeast of the water tower and RxR bridge, 140° to Moffet Field and 50° to salt flats.
B	"	4.40		
C	"	5.50		
D	"	5.30		

Table I cont.

Sta. #	Depth	Vol.-1	Time	Location
30A	1.52 m	3.40	14:30	Between bird cage and orange buoy "G". 135° to Moffet Field, 30° to salt flats, 330° to center of RxR bridge.
B	"	3.40		
C	"	5.40		
D	"	3.60		

Stations 1-17 were obtained on October 4-5, 1975. Stations 18-30 were obtained on October 18, 1975. The following is a listing of the tidal cycle:

	High Tide		Low Tide	
Date	Time	Ht.	Time	Ht.
10/4	12:18	2.71 m	19:15	0.00 m
10/5	12:59	2.87 m	19:59	0.15 m
10/18	11:65	2.49 m	18:53	0.18 m

of the boat with the crane and a 12 volt battery-powered water pump was used to supply fresh sea water for sieving. The pump intake hose was covered with a fine mesh screen to prevent non-benthic organisms from entering the sieving water.

Fauna from the two sieve fractions (1.0 and 0.5 mm) were placed in separate cotton containers. The mesh size openings of the cotton containers were substantially smaller than 0.5 mm, still allowing free entry of the narcotizing agent and fixative. The sieved fractions were placed in 0.9% propylene phenoxetol in sea water. Within one hour the sieved fractions were transferred to 10% buffered formalin. Prior to sorting the organisms were washed in fresh water and transferred to 70% isopropyl alcohol.

A fifth grab sample from each faunal station was taken for sediment analysis. Sediment volumes of approximately 15 ml were removed for partical size determination.

Water quality samples for laboratory analysis were collected and preserved according to the instructions given by the Pacific Environmental Laboratories (see their separate report for details). The samples were delivered to the Pacific Environmental Laboratories within six hours of collection (Standard Methods, 13th Edition, page 34). Fifteen stations with a total of 29 samples were made during the preliminary survey period (Figure 2, Table II).

Deep water station samples were collected every 3 meters, starting 0.5 m below the surface. Samples were collected in PVC Niskin sampling bottles Model 1010, 1.7 liter capacity.

Fig. 2
Water Quality Stations

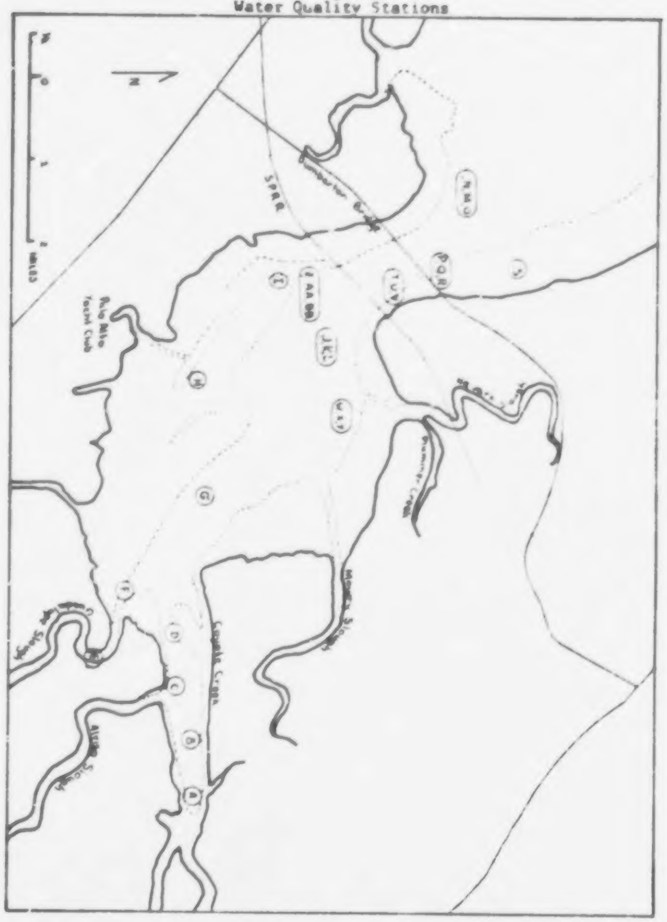


Table II

WATER QUALITY STATIONS

Sta. #	Location
A	Same as faunal station #1.
B	Same as faunal station #2.
C	Same as faunal station #3.
D	West of electrical towers in Coyote Creek, in line with the second electrical tower and the two tallest electrical towers on south side of Coyote Creek, near Guadalupe Slough entrance.
E	In Guadalupe Slough, between the electrical towers just south of N8 channel marker.
F	Same as faunal station #6.
G	Same as faunal station #24.
H	Bird cage buoy in Mayfield Slough.
I	Same as faunal station #13.
J,K,L	Positioned between the two large electrical poles centered north of the car bridge, and with the salt flats.
N,M,O	Marker R14 north of car bridge.
P,Q,R	First electrical tower east of car bridge on north side of bridge.
S	North of car bridge on east side of bay, 30° to KGO radio towers, 190° to center of car bridge.
T,U,V	Halfway between car bridge and railroad bridge in the center of the channel.
W,X,Y	150 yards north of R16, south of railroad bridge.
Z,AA,BB	South of railroad bridge, in line with Aqueduct building and salt flats in east side of bay.

Field measurements included dissolved oxygen, temperature, depth, and ph. Dissolved oxygen measurements were taken with a YSI Model 54ARC oxygen meter with a 30.48 m cable length for the probe. The oxygen probe has a built-in pressure compensation vent for deep water analysis. The calibration was done in the field for each measurement using the Air Calibration Technique for sea water (Standard Methods, page 480). The difference between air and water temperature was less than 5°C. The meter was field calibrated for a chloride concentration of 20,000 mg/1. The D.O. readings were corrected for actual chloride concentrations when the samples were analyzed and the results made available. Separate water samples were made for chloride concentration in order to correct D.O. measurements. These samples were analyzed by the Water Quality Laboratory of the Pacific Marine Station. Comparison of the results obtained from the Pacific Environmental Laboratories for chloride concentration with those of the Pacific Marine Station showed no significant difference.

The water temperature was measured with oceanographic reversing thermometers (.001 C° adjusted) attached to the Niskin collecting bottles. The ph was measured in the field with a Corning Model 610-A Expand Scale Meter. The water used for the ph measurement was that from the unpreserved water collected for laboratory analysis. Depth was measured with a Heathkit Model M1-1030 Fathometer.

Samples for coliform bacteria were collected at each station. Every tenth coliform sample was doubled for control

Table III

WATER QUALITY FIELD DATA

Sta. #	Depth m	D.O. mg/l	% D.O. Sat.	ph*	Chlorinity mg/l	Salinity ppt	Temp. C°
A	1.95	3.60	45.57		16,290	28.85	22.90
B	2.60	4.50	54.22		11,520	20.54	20.50
C	1.50	4.90	59.04		10,810	19.29	21.40
D	2.44	5.29	64.51		11,360	20.26	21.20
E	2.60	4.29	51.17		10,650	19.01	21.50
F	4.55	5.51	68.02		12,760	22.71	21.20
G	3.90	5.40	65.85		11,700	20.85	21.40
H	2.00	6.05	73.78		13,020	23.16	21.00
I	2.00	6.40	80.00		13,940	24.77	21.00
J	6.00	6.80	85.00		14,640	25.99	20.75
K	3.00	6.80	85.00		14,440	25.66	21.75
L	Surface	6.90	86.25		14,320	25.43	21.00
M	5.64	7.65	89.36		15,519	27.51	17.00
N	8.69	7.62	90.50		15,783	27.97	16.00
O	1.00	7.59	89.40		15,695	27.83	17.00
P	7.16	7.33	85.93		15,695	27.83	17.00
Q	4.11	7.62	89.43		15,872	28.05	17.00
R	1.00	7.04	82.43		15,607	27.67	17.00
S	0.50	8.97	108.47		15,322	27.17	17.00
T	8.67	7.72	90.61		15,827	28.05	17.00
U	5.64	7.63	89.46		15,651	27.74	17.00
V	0.5	7.66	89.46		15,376	27.27	17.00

Table III cont.

Sta. #	Depth m	D.O. mg/l	% D.O. Sat.	ph*	Chlorinity mg/l	Salinity ppt	Temp. C°
W	10.21	7.52	92.60		15,364	27.24	17.50
X	5.64	7.51	92.60		15,431	27.36	17.50
Y	0.50	7.50	92.57		15,497	27.48	17.50
Z	7.16	7.51	92.60		15,475	27.44	17.50
AA	4.11	7.52	92.61		15,300	27.13	17.50
BB	0.50	7.52	92.61		15,387	27.29	17.50

* *Equipment Malfunction

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland and Parsons.

Table IV

Benthic - Water Quality

Faunal Sta. #	D.O.	% D.O. Sat.	Temp. C°	Chlorosity mg/l	Salinity ppt.	Turbidity FTU
18				15,036	26.68	16.0
19	7.47	98.71	17.0	14,772	26.21	11.0
20	7.05	93.60	17.0	14,640	25.99	8.3
21	7.11	81.82	17.0	14,113	25.06	18.0
22	6.90	79.31	17.5	14,003	24.87	6.0
23	7.98	93.01	17.0	15,168	26.91	5.8
24	7.93	95.12	17.0	14,651	26.00	5.2
25	7.58	90.56	17.8	14,288	25.38	6.3
26	8.73	106.08	18.0	14,113	25.06	6.5
27	8.61	107.50	18.0	15,497	26.25	4.9
28			18.0			
29	9.27	113.46	17.5	14,772	27.17	7.8
30	8.56	104.90	18.1	14,794	26.25	9.0

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Turbidity was determined by the Nephelometric Method (Standard Methods, 13th edition) and reported in Formazin Turbidity Units (FTU).

purposes. Collection and handling procedures followed Standard Methods, 13th Edition, pages 657-660.

Results of the Water Quality Field Data is summarized in Table III. Additional water quality field data was collected at some benthic stations (Table IV).

The tidal phase for the samples collected on 9/2/75 was; high tide at 11:15, 2.23 m and low tide at 16:40, 0.79 m. For samples collected on 10/17/75, high tide was 11:29, 2.499 m and low tide was 18:20, 0.305 m. Only that part of the tidal cycle during which the collections occurred was listed.

III. Results

The 0.5 mm Sieve fraction

The species selected for further study were based upon abundance data compiled from analyzing the 1.0 mm sieve fraction. The 0.5 mm sieve fractions were sorted for species diversity and a number of species were added to the station faunal lists. However, the animals in these fractions were not counted. Many of the fractions contained large numbers of oligochaetes; primarily the species *Peloscolex gabriellae*, *P. apectinatus*, *P. nerthoides*. These same fractions also contained the polychaetes *Pseudopolydora kempi*, *Polydora ligni*, *Exogone lourei* and *Streblospio benedicti*; some small amphipods; *Ampelisca milleri*, nematods and ostracods. The small size of the animals and the high organic content of the sieve fraction lead us to believe it was possible that much of the populations of the smallest forms were not completely retained on the 0.5 mm sieve. Therefore, tests were conducted on some of the fractions to determine if the small forms would go through the sieve with additional washing. It was discovered that when additional sieving was gently done and the waste water sieved through .250 mm and .180 mm sieves, that some of the species did indeed pass through the 0.5 mm screen. Representatives of the three oligochaete species; the polychaetes, *Streblospio benedicti*, *Exogone lourei*, nematods and some ostracods were retained on the .250 mm and 180 mm sieves. With this preliminary information it was felt that attempts to determine abundancies of the smaller animals retained on the 0.5 mm screen would produce misleading conclusions. It is proposed that additional tests be conducted based upon the design used by Reish (1959) and Hessler and Jumars (1974) where replicate samples are taken and sieved through a series of screens composed of 1.0 mm, 0.5 mm, .250mm and .180 mm fractions. Cumulative percents of the animal species and number collected in each sieve size could then be determined. If the results are similar to Reish and Hessler and Jumarsa significant number of the smaller forms will go through the 0.5 mm sieve. If this is the case, abundance data from the 0.5 mm screen for those species of which significant numbers pass through the screen cannot be used for population studies. These very limited observations supported by data from Reish and others indicate that in order to study the smaller size fauna, techniques must be used which reflect the questions asked and the characteristics of the animals. With very large numbers of individuals in 0.5 mm fractions and the fact that many individuals may pass through the 0.5 mm screen, a different program would have to be developed to monitor this population in a meaningful way. The 0.5 mm fractions for this study will not be counted until further field tests confirm or refute our observation and preliminary tests. It should be pointed out that if smaller sieve sizes are needed to monitor the smaller sized animals, then a smaller grab sample, with more replicates might also be needed. This cannot be done within the existing budget.

During the sieve tests it was noted that some small *Gemma gemma* also passed through the 0.5 mm sieve. Muus (1973) pointed out that in many papers on size class determination using bivalves, the authors have not selected the right sieve size for the species being studied. His studies showed that most of the bivalve larvae collected in the Øresund (Denmark) were smaller than 0.5 mm. If a sieve size larger than the spat is used the first year class is often reported as spat. This problem can cause misleading conclusion particularly in short duration studies. Muus (1973) has reported the spat size of a number of bivalves in the same genus as those in this study are about 0.4 mm. Therefore, it is proposed to review this possibility and adjust the sampling technique to reflect the capture of the spat for those bivalves selected for study.

Sediment Analysis

Sediment samples were collected during the sampling periods of September 1, October 4 and October 18, 1975. The September samples were dry sieved and October samples were wet sieved. This comparative study was conducted to determine the most accurate method of particle size determination for animal-sediment relationships. Sieving was done through 7.62 cm Taylor round sieves with mesh openings of 0.600 mm, 0.425 mm, 0.250 mm, 0.180 mm, 0.75 mm, these mesh sizes correspond to phi units of 0.740, 1.234, 2.000, 2.474, 3.000, and 3.737. Particle size relationships were analyzed by computer and the comparative results of both wet and dry sieving are illustrated in Figures 3 and 4. The results indicate that dry sieving produces mean grain sizes in the coarse or medium sand size range. Wet sieving clearly demonstrates that the particle sizes are generally skewed to the fine sand, silt and clay fractions. The disparity in results between the two methods are most likely related to the fact that when sediments with large percentages of silt and clay mixed with organic matter are dried and sieved, the fines form conglomerates which are then retained on the larger sieve sizes. The dry sieve analysis indicates considerable variability between stations whereas obvious exceptions for the wet sieved samples are the stations taken in the channel areas (7, 23, 24, and 27) where the oyster shell fragments made up a large percentage, thereby increasing the mean grain size. Tables V and VI show the difference in the percent weight of the sieve sizes after sieving.

Neither wet nor dry sieving is accurate enough to determine the differences in small scale heterogeneity. Microscopic analysis is necessary to accurately relate species distribution in small areas to sediment differences (Smith,

Fig. 3

Dry Sieved Sediment Analysis

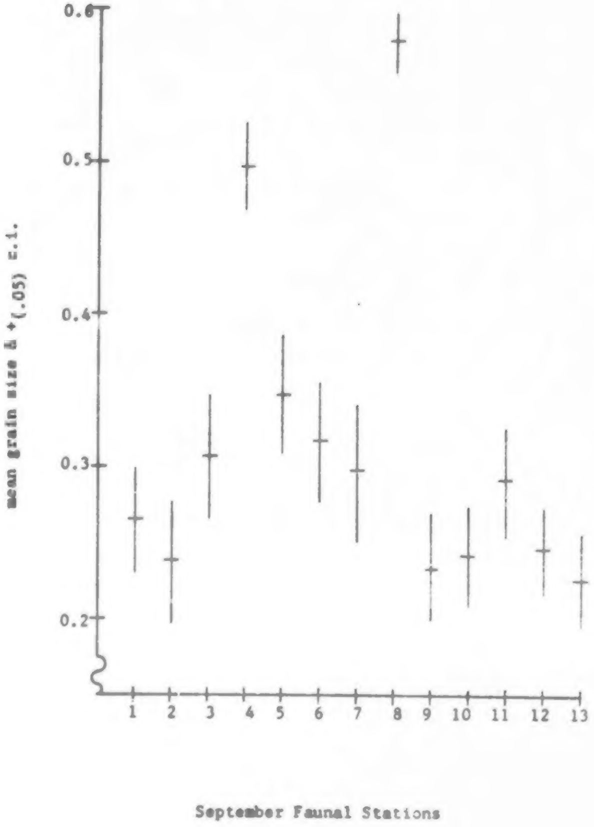


Fig. 4

Wet Sieved Sediment Analysis

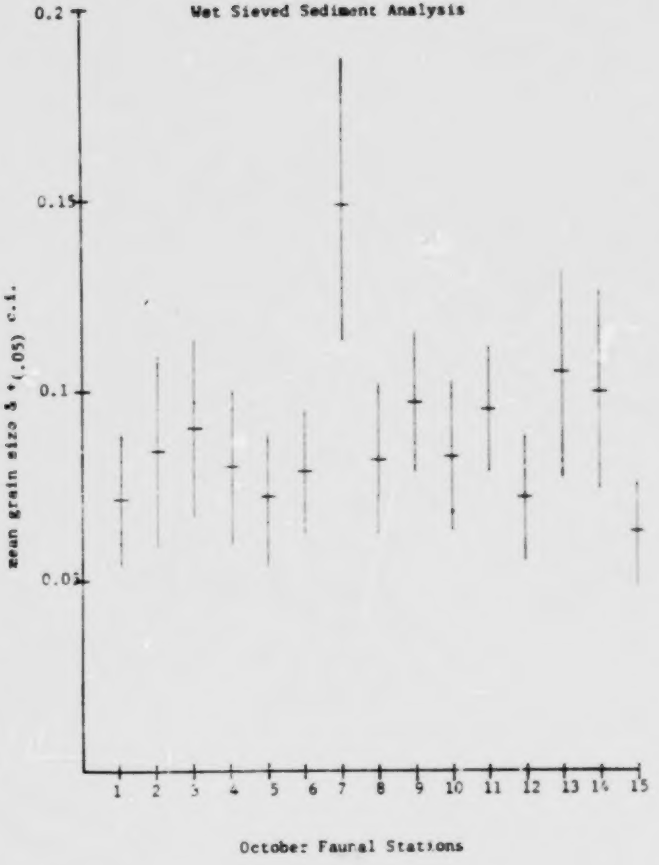


Fig. 4 cont.

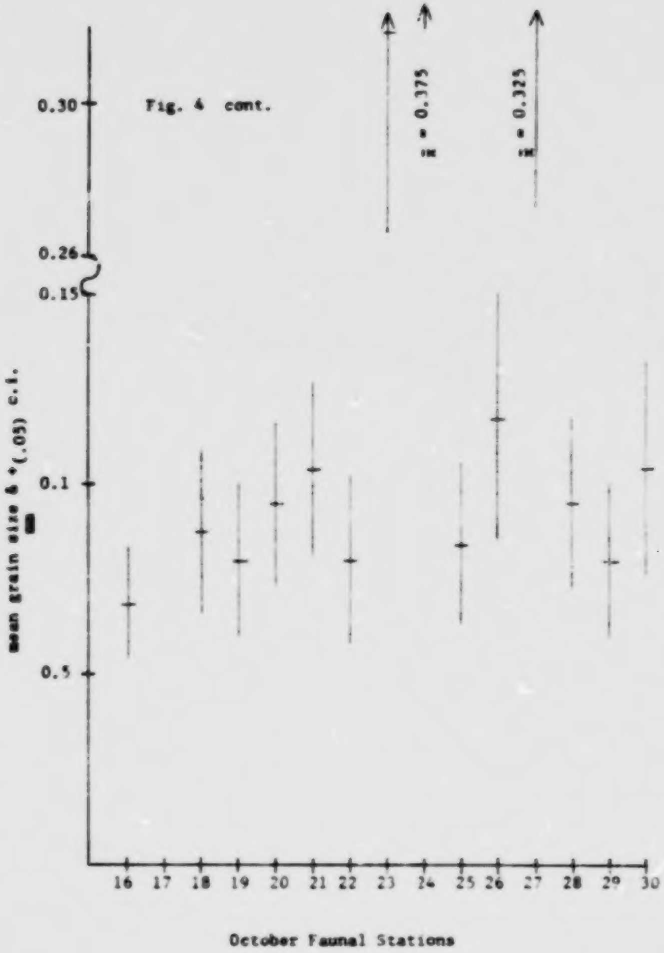


Table V

DRY SIEVED ANALYSIS

PERCENT SAND SIZE - BY WEIGHT

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
1	15.450	11.332	14.717	36.939	16.396	2.575	0.589
2	22.267	5.263	17.814	10.121	6.073	6.073	32.388
3	25.316	11.685	22.395	22.882	11.685	3.700	3.894
4	69.587	7.850	19.771	2.229	0.349	0.019	0.194
5	33.499	11.185	20.937	19.008	9.091	0.331	2.975
6	25.926	11.852	20.741	27.259	8.963	3.333	1.926
7	29.863	9.036	14.126	9.039	15.335	15.335	7.264
8	96.774	0.101	0.504	0.403	0.101	0.101	2.016
9	12.207	12.207	16.439	16.276	23.177	14.974	4.720
10	10.791	15.481	18.087	14.868	31.116	7.511	2.146
11	17.702	16.459	19.409	32.298	11.242	1.801	1.553
12	3.956	22.101	23.192	28.922	16.508	3.956	1.364
13	6.093	19.572	19.572	12.851	31.019	9.047	1.846

Table VI

WET SIEVED ANALYSIS

SEDIMENT ANALYSIS - RAW DATA SHEET

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
1	1.183	1.349	1.805	7.593	1.037	2.033	85.000
2	4.025	0.767	1.648	5.443	1.366	2.044	78.840
3	3.170	1.423	4.552	8.739	2.032	3.224	76.819
4	2.459	1.031	3.435	7.377	1.916	2.025	81.757
5	1.404	0.146	4.621	6.303	1.536	1.404	84.587
6	0.590	1.789	4.679	8.925	4.954	2.123	80.520
7	13.707	0.952	6.854	7.953	2.240	1.448	68.160
8	2.145	0.728	4.938	5.666	5.785	4.091	76.648
9	1.624	0.874	5.678	11.356	11.762	12.832	55.894
10	2.139	1.134	1.924	12.102	0.373	6.288	76.041
11	0.939	0.122	5.963	12.279	14.498	14.364	51.725
12	1.381	0.705	1.777	7.065	1.998	7.344	79.686
13	5.538	1.282	1.796	11.179	4.333	8.846	67.026
14	4.518	2.170	4.269	7.115	3.939	4.767	73.212

Table VI cont.

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
15	0.619	0.380	2.240	5.749	0.014	3.283	85.755
16	0.803	0.233	2.279	8.691	2.487	3.316	82.191
17	-	-	-	-	-	-	-
18	2.524	1.017	6.955	6.729	1.783	2.825	78.167
19	1.929	0.261	7.741	5.103	1.705	3.199	80.062
20	1.936	1.416	11.242	7.091	1.646	1.779	74.891
21	1.566	4.530	10.542	6.164	3.486	4.968	68.744
22	3.232	0.715	1.609	7.000	2.130	3.232	82.082
23	47.157	1.711	3.889	6.412	1.698	2.461	40.094
24	43.987	14.398	5.379	5.927	0.923	1.428	25.564
25	2.510	0.363	4.730	9.504	1.741	3.424	77.728
26	8.602	1.404	5.318	5.485	1.249	2.614	75.328
27	44.953	2.361	3.723	6.850	5.008	3.204	33.900
28	2.210	1.214	10.617	6.771	2.555	3.398	73.234
29	2.509	0.271	3.743	6.387	2.929	7.459	76.702
30	6.445	0.542	2.578	8.437	5.273	5.361	71.364

1975). However, these techniques are expensive and time consuming; well beyond the scope of this project. In view of this fact, wet sieving is the best alternative for a reasonable estimation of particle size distribution.

A technique for determining differing sand environments is a scatter diagram of skewness (G_1) vs. kurtosis (G_2) taken from Mason and Folk (1958). Figure 5 is a G_1 vs G_2 scatter diagram for the wet sieved samples. Each station is represented by a dot and station number. These results indicate three sand environments with the channel stations clearly separated in size characteristics. The fact that many of the stations are closely grouped does not allow a clear cut selection of stations based upon sediment characteristics alone. Permanent stations have been selected in each major division of sediments in order to monitor these different environments.

Determination of Permanent Sampling Stations and Selection of Representative Species.

The primary objective for establishing permanent sampling stations is to monitor the fauna which best represents the South Bay area. The selection of the stations and representative species are closely related. Table VII summarizes the pooled species data for all stations and all replicate samples. The criteria for selecting the species which best represent the South Bay area are those species which have a high frequency of occurrence, a high mean density, and a low coefficient of variation (CV). Coefficients of variation are

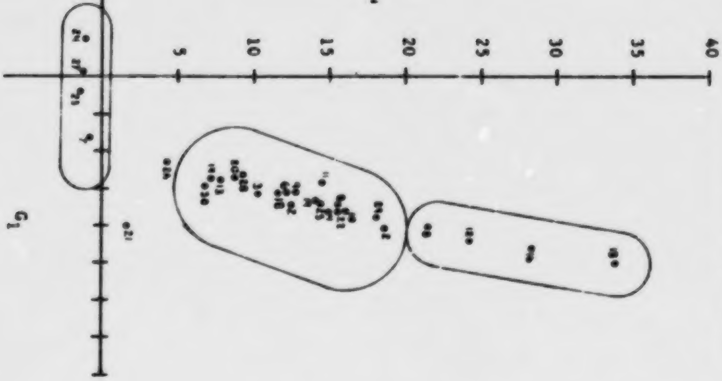


Fig. 5
Wet Sieved G_1-G_2 Analysis

Table VII

Faunal Abundances Taken With a 0.05 m^2 Ponar Grab

SPECIES	TOTAL NUMBER	MEAN (CV[1])	$t_{(.05)}$ 95% c.i.[2] upper	lower	MEAN NO. PER m^2	# SAMPLES PRESENT	FREQ.
Gemma gemma	2738	23.809(17.2)	31.979	15.638	432.89	71	.617
Amphipoda*-pooled	2135	18.565(21.4)	26.435	10.695	337.55	54	.470
Lyonsia californica	2126	18.487(23.1)	26.938	10.036	336.13	62	.539
Modiolus senhousia	1614	14.035(14.4)	18.024	10.045	263.40	68	.591
Macoma inguinata	1017	8.843(16.8)	11.778	5.909	160.78	67	.583
Heteromastus filiformis	986	8.574(13.6)	10.887	6.261	155.89	81	.704
Streblospio benedicti	397	3.452(31.9)	5.632	1.272	62.76	37	.322
Asychis elongata	216	1.878(17.7)	2.536	1.220	34.15	41	.357
Marphysa sanguinea	146	1.270(18.2)	1.726	0.813	23.09	38	.330
Macoma balthica	139	1.209(17.1)	1.618	0.799	21.98	39	.339
Glycinde polygnatha	134	1.165(47.5)	2.261	0.069	21.18	31	.270
Eteone lighti	91	0.791(18.4)	1.080	0.502	14.38	34	.296
Amaeana occidentalis	85	0.739(66.8)	1.233	0.246	13.44	15	.130
Neanthes succinea	78	0.678(22.4)	0.979	0.377	12.33	26	.226

1=cv-coefficient of variation

2=confidence intervals

H-20

Table VII cont.

SPECIES	NUMBER	MEAN (CV^1)	$t_{(.05)}$ 95% c.i.^{2}		MEAN NO. PER m^2	# SAMPLES PRESENT	FREQ.
			upper	lower			
Pseudolpolydora kempi	69	0.600(59.2)	1.303	0.000	10.91	14	.122
Polydora ligni	30	0.261(46.7)	0.502	0.019	4.75	10	.087
Tapes japonica	27	0.235(24.3)	0.348	0.121	4.27	18	.157
Chaetozone sp.	15	0.130(33.5)	0.217	0.044	2.36	10	.087
Nephtys caecoides	13	0.113(39.0)	0.200	0.026	2.05	9	.078
Harmothoe imbricata	7	0.061(46.7)	0.117	0.005	1.11	5	.043
Exogone lourei	3	0.026(57.2)	0.056	0.000	0.47	3	.026
Macoma nasuta	2	0.017(71.0)	0.042	0.000	0.31	2	.017
Ciona intestinalis	121					15	.134
Crepidula fornicata	11					4	.035
Caridea fragment	1					1	.009
Balanus sp.	1					1	.009
Stylatula elongata	7					4	.035
Capitella capitata	1					1	.009
Spio filicornis	1					1	.009

1=cv-coefficient of variation

2=confidence intervals

Table VII cont.

SPECIES	TOTAL NUMBER	MEAN (CV^1)	$t_{(.05)}$ 95% c.i.^{2}		MEAN NO. PER m^2	# SAMPLES PRESENT	FREQ.
			upper	lower			
Pyromaia tuberculata	1					1	.009
Nassarius obsoletus	1					1	.009
Bryozoa	1					1	.009
Ostrea lurida	1					1	.009
Leptocottus armatus	2					1	.009
Amphipoda*							
Ampelisca milleri							
Aoroides columbiae							
Isopoda							
Synidotea laticulata							
Oligochaetea							
Peloscolex apectinatus							
P. gabriellae							
P. nerthoides							
Ostracoda							
Sarsiella spp.							

1=cv-coefficient of variation

2=confidence intervals

used to compare the variances of two or more populations independent of the magnitude of their means. The coefficient of variation is the standard deviation expressed as a percentage of the mean. The selected criteria will indicate which species populations have wide-spread occurrence, comparatively high densities, and a minimal error factor to allow easier determination of minor population fluctuations. Based upon the data in Table VII the representative species are: the bivalves: *Gemma gemma*, *Lyonsia california*, *Musculus senhousia*, *Macoma inquinata*, and the polychaete; *Heteromastus filiformis*. Final determination of the amphipod species has not been completed. When this is completed, dominant amphipod species will be incorporated into the present representative species analysis for future sampling periods.

Some of the permanent sampling stations were chosen according to the distribution of representative species within each of the thirty preliminary stations (Table VII). Only those stations where each of the representative species occurred in three or more replicates are listed. The requirements for determining these permanent sampling stations based on the established representative species information were: (1) enough individuals present so that changes in the population densities would not eliminate the population, and (2) a low coefficient of variation that will enable minor population fluctuations to be more easily noticed.

Without a prior knowledge of the range of population fluctuations of the representative species, the minimal densities required to maintain a yearly measureable population is not known. Therefore, representative species have been chosen which have the largest number of individuals and a low coefficient of variation.

It is evident from Table VIII that any given fifteen stations will not satisfactorily include all eight representative species. Therefore, stations were selected which best reflect large numbers of the representative species, either one station for a particular species or for several species. The following is a list of the stations and their respective species which will be emphasized during the study: *Gemma gemma*, stations 18, 19, and 5; *Lyonsia californica*, stations 18 and 19; *Musculus senhousia*, stations 12 and 13; *Macoma inquinata*, stations 1 and 19; and *Heteromastus filiformis*, stations 19, 20, and 30. From a total of 30 stations, only the selected eight stations will provide any meaningful data on animal populations. The remaining seven stations were selected because of their location to the project, i.e. near the diffuser discharge point or because they were representative of the major sediment classes. These remaining stations include 7, 8, 9, 10, 11, 23, and 25 bringing the total to fifteen stations to be sampled three more times during 1976 (Fig. 6).

Size Frequency Analysis of Selected Bivalves.

Quantitative species data alone does not yield sufficient information on age group division of animal populations to understand fluctuation patterns. The benefits of knowing the age distribution, through time, produces information on such

Table VIII

Sta.#	G. gemma		L. californica		M. senhousia		M. inquinata	
	$\bar{x}^1$	CV^2	$\bar{x}$	CV	$\bar{x}$	CV	$\bar{x}$	CV
1							68.00	19.75
2							19.00	11.16
3								
4	31.00	31.69	7.25	42.65			33.00	25.43
5	66.75	16.05			11.25	40.79		
6	24.67	43.93	35.33	9.29	25.00	20.78	5.00	23.09
7								
8								
9	11.75	19.46	1.25	38.30	46.25	23.59	0.25	100.00
10					15.00	26.11		
11	3.00	78.17	7.00	29.16	2.25	42.07	2.75	27.27
12	12.25	10.20			26.50	13.30	1.25	50.33
13					56.00	20.66		
14					10.25	35.03	10.25	35.03
15					17.00	26.20	17.00	26.20
16					17.25	15.41		
17	72.50	72.73						
18	129.25	20.96	106.75	30.85	2.75	58.18	7.75	29.51
19	107.25	18.16	78.50	8.89			22.50	6.41
20	9.75	8.76	2.75	31.05			12.25	22.45
21	108.00	35.52	17.00	14.21			8.75	23.50
22	13.75	7.42					6.50	22.21
23								
24								
25	30.00	57.20	24.00	43.13	47.00	37.16	1.00	70.71
26	10.75	20.93	7.50	31.03	30.50	25.20	14.00	14.05
27								
28					6.75	27.96		
29					50.00	32.68		
30	26.33	11.25	9.75	47.26	7.25	41.90		

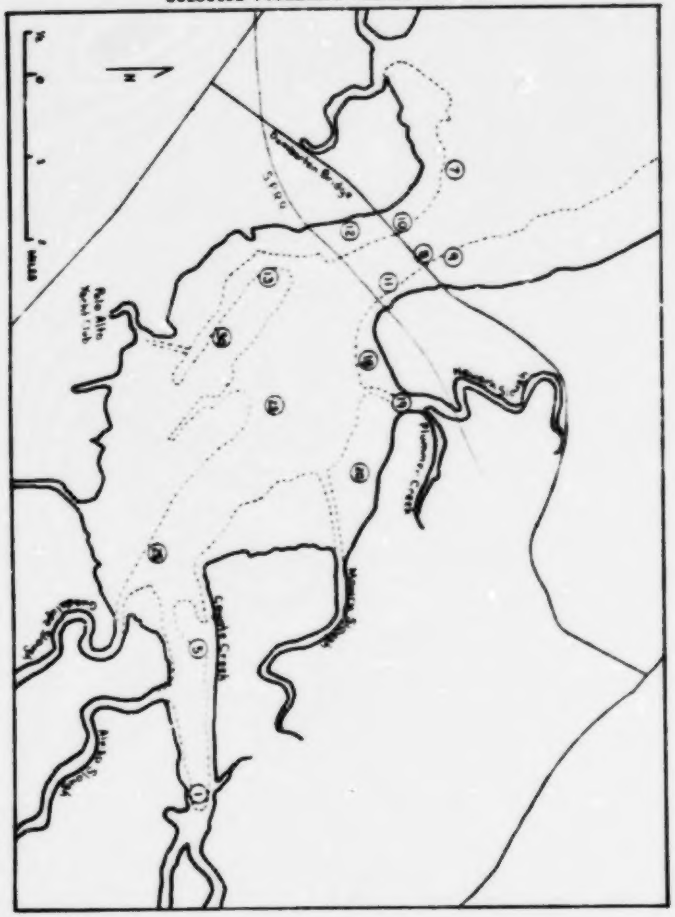
1 = mean
2 = coefficient of variation

Table VIII cont.

Sta.#	H. filiformis		A. elongata		N. sanguinea		M. balthica	
	$\bar{x}^1$	CV^2	$\bar{x}$	CV	$\bar{x}$	CV	$\bar{x}$	CV
1							7.25	48.66
2							2.75	31.11
3								
4	0.67	100.00					4.25	43.34
5								
6	4.33	65.77					1.67	85.88
7					2.50	50.33		
8			5.00	52.92				
9	3.00	19.25	6.00	13.61				
10	4.25	58.72						
11	3.25	60.73					0.50	57.73
12								
13	4.00	36.80	5.75	44.55	1.50	43.03		
14	1.25	39.89						
15	3.00	40.82						
16			5.50	56.61				
17								
18	24.50	28.11	8.75	35.94			1.00	70.71
19	38.50	16.92	1.25	38.30				
20	39.25	13.57	4.00	27.00			2.75	27.27
21	18.25	27.34						
22	12.25	27.76					2.75	34.38
23	2.25	37.95			8.75	17.69		
24	1.50	33.33			2.75	9.09		
25	9.75	52.02						
26	13.00	42.83					1.25	20.00
27	2.50	25.82						
28	12.75	37.67	1.00	40.82	4.25	17.65		
29	5.50	33.61	9.25	35.41				
30	27.50	19.94	4.00	33.85	2.75	28.93		

1 = mean
2 = coefficient of variation

Fig. 6
Selected Permanent Faunal Stations



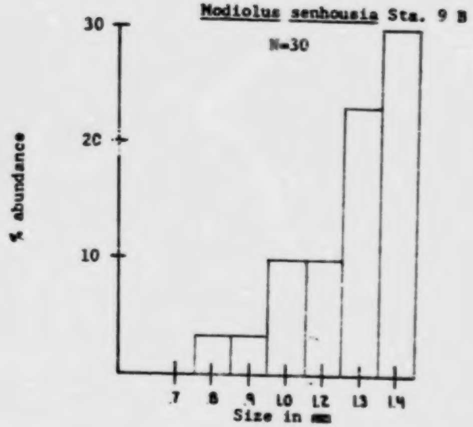
basic ecological factors as growth rate, mortality, reproduction patterns, and population age structure. Combining these factors assists in determining recruitment fluctuation patterns caused by recruitment and age stability, determining whether the population is increasing, maintaining itself, or declining. It would not be possible to determine the size frequency for all the species collected within the time frame and financial restrictions of this study, therefore, eight species have been selected for this form of analysis.

Without prior information on the species age-size relationship, size distribution histograms are commonly used to represent the age structure of animal populations. The general assumption in size distribution analysis, is that age varies linearly with size.

The bivalves *Modiolus senhousia* and *Macoma inquinata* were selected to demonstrate size variation. Length and width for each species was measured and correlated. The results showed that the correlation coefficients for both *M. senhousia* and *M. inquinata* were significant at the 1% level, r= 0.874 and 0.938. Since the length and width strongly covaried, either of the two measurements may be used to indicate size. Size distribution histograms for the selected species (Fig. 7) clearly indicate size variation within the populations. The other selected species will also be measured either by counting segments in polychaetes or carapace length in amphipods.

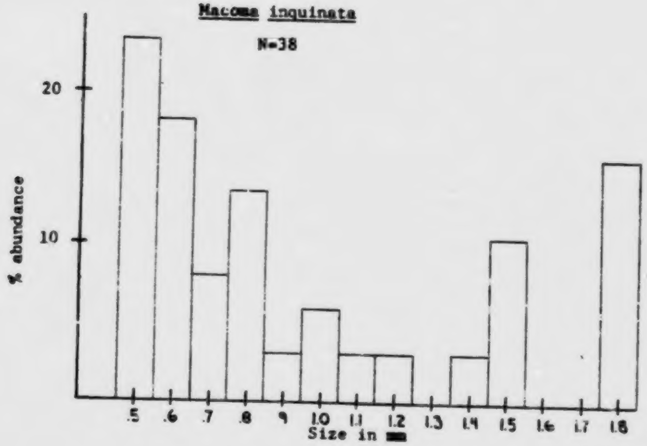
As was pointed out earlier, the sieve size will be very important if the spat are to be collected and incorporated

Fig. 7



Modiolus senhousia Sta. 9 B

N=30



Macoma inquinata

N=38

into the size class determination. Unfortunately, the frequency of sampling is only four times a year. Size class and spat settlement data are more meaningful if sampling periods are monthly. However, monthly sampling is beyond the scope of the project.

Ponar Grab Efficiency.

The selection of the Ponar Grab (0.05 m^2) was based upon the weight of the grab and the ease and safety of use from a small craft. The South San Francisco Bay is largely a shallow water area, with some chosen faunal stations accessible only at high tide. This limitation necessitated the use of a small craft and light sampling equipment.

Replicate Analysis.

The fauna collected by four replicate samples at each station was analyzed in several ways. The pooled number of species and individuals for each replicate are shown in Figures 8 and 9. The results from pooling the data indicate that one replicate sufficiently estimates combined species and individual parameters as well as four replicates.

However, since the objective of the study is to monitor selected species, these representative species and their respective stations were analyzed individually for replicate accuracy (Table IX). The samples were grouped into 2, 3, and 4 replicates for the analysis (sets AB, ABC, ABCD). Based upon Table IX, three replicates per station would be the minimal for obtaining needed quantitative data for the study and four replicates would yield a more accurate analysis

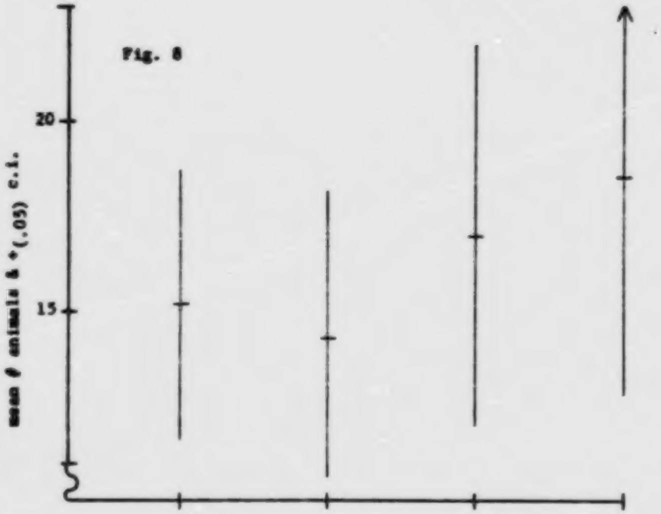


Fig. 8

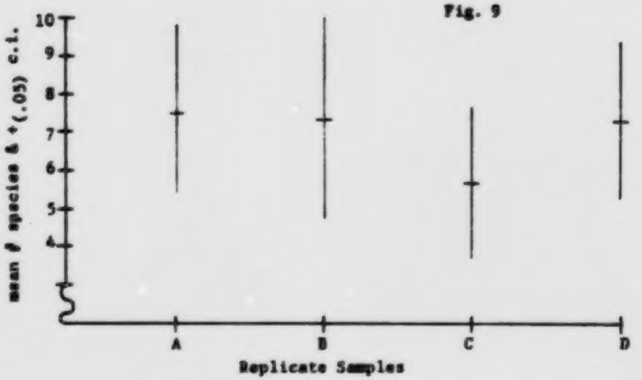


Fig. 9

Table IX

Sta. #	N	$\bar{x}$	s	$s_{\bar{y}}$	CV
Macoma inquinata					
1	2	62.00	9.89	6.99	11.28
	3	76.33	25.79	14.89	19.51
	4	68.00	26.85	13.42	19.74
19	2	22.50	4.94	3.49	15.55
	3	22.60	3.51	2.02	8.97
	4	22.50	2.88	1.44	6.41
Gemma gemma					
5	2	70.00	26.87	18.99	27.14
	3	73.66	20.03	11.56	15.70
	4	66.75	21.42	10.71	16.04
18	2	159.50	71.41	50.50	31.66
	3	137.67	63.08	36.42	26.45
	4	129.25	54.19	27.09	20.96
19	2	130.50	41.71	29.50	22.60
	3	109.00	47.50	27.42	25.16
	4	107.25	38.94	19.47	18.15
Modiolus senhousia					
12	2	32.50	2.12	1.49	4.61
	3	28.33	7.37	4.25	15.02
	4	26.50	7.04	3.52	13.35
13	2	37.00	9.00	6.36	17.19
	3	49.66	23.71	13.69	27.56
	4	56.00	23.13	11.56	20.65

$\bar{x}$ = mean
s = standard deviation
$s_{\bar{y}}$ = standard error
CV = coefficient of variation

Table IX cont.

Sta. #	N	$\bar{x}$	s	$s_{\bar{y}}$	CV
Lyonsia californica					
18	2	153.50	6.36	4.49	2.93
	3	107.00	80.66	46.57	43.52
	4	106.75	65.86	32.93	30.85
19	2	87.50	14.84	10.49	11.99
	3	80.00	16.70	9.64	12.05
	4	78.50	13.96	6.98	8.89
Heteromastus filiformis					
19	2	36.00	15.55	10.99	21.60
	3	41.33	14.36	8.29	20.06
	4	38.50	13.02	6.51	16.91
20	2	33.00	8.48	6.00	18.18
	3	39.66	13.01	7.51	18.94
	4	39.25	10.65	5.32	13.57
30	2	35.00	11.31	7.99	22.85
	3	29.33	12.66	7.31	24.92
	4	27.50	10.96	5.48	19.44

$\bar{x}$ = mean
s = standard deviation
$s_{\bar{y}}$ = standard error
CV = coefficient of variation

of the representative species populations.

The use of a larger sampling device in aggregate populations will increase the probability of increased numbers of rare species, but concurrently increase the probability of a higher standard error. A higher standard error will lead to less accurate data for analyzing abundance fluctuations. The use of more replicates at each station may further diminish the standard error to a relatively constant value. The magnitude of the error factor is dependent upon the type of faunal distribution in space. Due to the cost of analyzing each sample, more than four replicates per station for 15 stations for three more sampling periods is outside the financial limits of the contract.

Volume Analysis.

The effect of different grab volumes on obtaining higher species numbers was tested by correlation using the product-moment correlation coefficient for key species. Different transformations of the species abundance raw data were used to obtain the highest correlation coefficients. Of the six representative species tested, *H. filiformis*, *M. inquinata*, and *G. gemma* had significant correlation coefficients (Figs. 10, 11, 12). Based on the existing sampling program and the presented correlations, to maintain sufficient animal densities per grab, the recommended minimum volume is 3.0 liters.

IV. Summary and Conclusions

1. Fifteen permanent stations have been selected based upon the abundance of the representative species, project needs and sediment characteristics.

Fig. 10

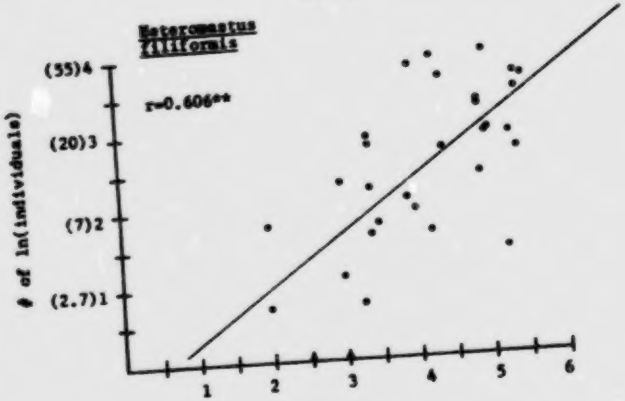


Fig. 11

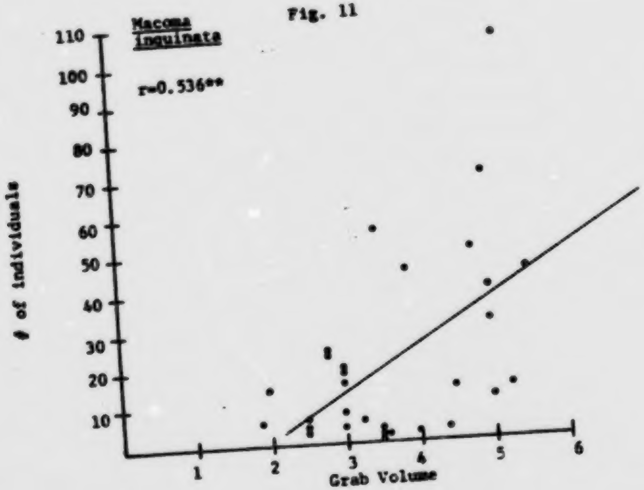
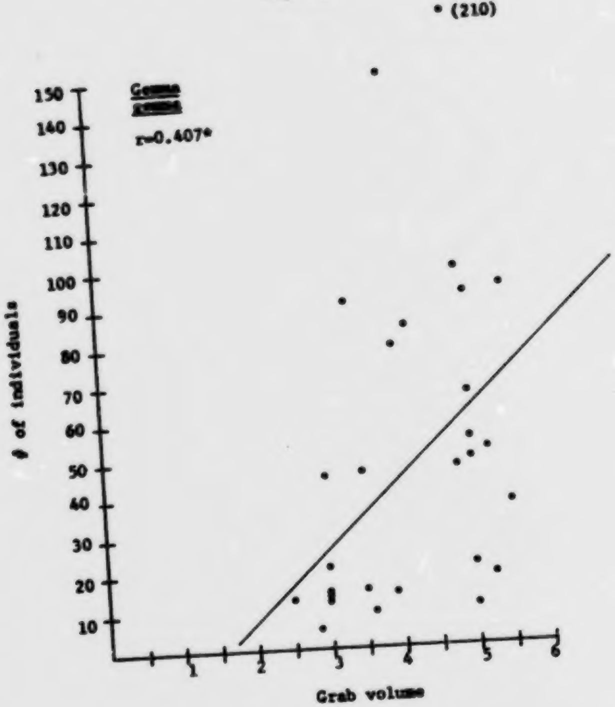


Fig. 12



2. The criteria for selecting the species which best represent the South Bay area are those species which have a high frequency of occurrence, a high mean density, and a low coefficient of variation (CV). The representative species are: the bivalves; Gemma gemma, Lyonsia californica, Musculus senhousia, Macoma inquinata, and the polychaete; Heteromostus filiformis. Amphipod species are also being incorporated into the species analysis.
3. The efficiency of the Ponar grab (0.05 m^2) to collect sufficient abundance data was analyzed. It was found that four replicates would yield a more accurate analysis of the representative species. A volume of 3.0 liters was found to be the minimum recommended to maintain sufficient animal densities per grab.
4. Tests were conducted on the 0.5 mm sieve fraction to determine if some of the smaller species were completely retained on the sieve. It was found that representatives of three oligochaete species; the polychaetes, Streblospio benedicti, Exogone lourei, nematods and some ostracods passed through the 0.5 mm screen and were retained in the .250 mm and .180mm sieves. Further field tests must be conducted before a decision can be made as to whether these smaller forms should be counted in the 0.5 mm sieve fraction.
5. Wet and dry sieving methods were compared and it was found that dry sieving resulted in data skewed toward the course and medium sands. Wet sieving showed the substrata to be composed of large amounts of silt and clay particles. Wet sieving is the best alternative for a reasonable estimation of particle size distribution.
6. Representative data was presented on size frequency analysis for selected bivalves to demonstrate the type of information to be gathered on the selected representative species.
7. Ameeting will be held to formalize arrangements with the California Academy of Science to curate the collections from South Bay. See Attachment I for deposition instruction from Dr. Welton Lee.

Personnel Involved or Consulted on the Project:

Dr. James Blake, Pacific Marine Station. Identification and counting of the Polychaetes.

Dr. Scott Gray, Environmental Services Section - Bechtel. Identification and counting of the amphipods.

Dr. Edmund H. Smith, Bionomics, Project Leader. Identification and counting of the mollusca.

Mr. David William, Bionomics. Assisted in field and laboratory work on the project.

References Cited

Hessler, Robert R., and Peter A. Jumars, 1974, Abyssal Community Analysis from replicate box cores in the central North Pacific. Deep Sea Res. 21:185-209.

Mason, Curtis C. and Robert L. Folk, 1958, Differentiation of beach, dune, and aeolian flat environments by size analysis, Mustang Island, Texas. J. Sed. Pet. 28:211-226.

Muus, Kirsten, 1973. Settling, growth and mortality of young bivalves in the Øresund. Ophelia, 12:79-116.

Reish, Donald J. 1959. A discussion of the importance of the screen size in washing quantitative marine bottom samples. Ecology 40:307-309.

Smith, E. H., 1975. Animal-Sediment relationship in Bays and Estuaries, Fed. Est. Assoc. (in press).

ATTACHMENT I

RECOMMENDATIONS CONCERNING DEPOSITION OF SOUTH BAY, SAN PABLO BAY, AND PETALUMA CREEK COLLECTIONS

1. Concerning the amount of material to be deposited, the department is particularly interested in obtaining the "type" or reference collection (on which the other identifications will presumably be based), specimens of particular interest to us (rare specimens, new records, or highly variable species), and small representative collections of the commoner species. The department can curate and maintain this amount of material at relatively low cost.

2. The department would also be willing to maintain the entire collection, but the extent of material and curation expense would be such that these expenses would have to be underwritten by the consultant, since the department does not have sufficient funds or time to fully curate large collections without some assistance.

3. A final decision concerning the amount of material which the department might wish to obtain must await completion of the sampling program and examination of the species list and the size and state of the collections. For example, the department would in all likelihood not be willing to curate 50,000 specimens of *Mya arenaria* unless financial assistance was available to do so.

4. The department has extensive holdings from the Redwood City area, but rather limited amounts from the areas to be covered in the intended study: that is: the south Bay, especially south of the Dumbarton Bridge; San Pablo Bay; and Petaluma Creek. The department is particularly interested in material from the latter two areas.

5. We recommend the following techniques be used for preservation and curation:

The specimens should be relaxed, and then fixed in 10% buffered formalin, on the day of collection. Within five weeks the specimens should be washed in fresh water, and transferred to 75% ethanol. To keep space required for specimen storage to a reasonable level, we recommend the use of various size containers, especially 4 or 8 ounce, with plastic screwcap lids. Into each jar would be placed all of the specimens from one species, from one station, from one sampling period. Specimens from different replicates should NOT be combined, but should be placed in separate glass vials within the jar, capped with cotton, and INVERTED in the jar to prevent dessication. Each replicate should be labeled with the station number, station latitude and longitude, replicate number, date and collector. Inside the jar should be placed a label indicating the station number and position, replicates enclosed, date, collector, and taxon.

ATTACHMENT I cont.

When only a few scattered specimens or species are present, different lots may be placed in vials in the same jar, but must be treated as completely separate samples. That is, each vial should be fully labeled with station number and position, replicate number, date, collector, and taxon. Any specimen lot which contains errors or which is left unlabeled cannot be traced, and thus is useless.

Labels should be made of 30% rag paper or better, or plastic paper; India ink or pencil should be used, not ball point.

The department can provide specifications for standard museum containers used in the departmental collections; use of these containers would reduce curation costs and streamline operations.

All specimens deposited in the department MUST be accompanied by full station data at the time of deposit, so that full and accurate information may be placed on the museum labels. These data should include station number, latitude and longitude, depth, date, and collector, and such other information as might be available (sediment type, time of collection, equipment used, etc.). A complete species list, taxonomic work sheets, and a copy of the final report should also be provided as soon as possible.

When material is removed from a specimen lot for inclusion in the reference collection, for dissection, or for other purposes, a note indicating the number of specimens removed, the purpose, the date of removal, and the name of the person removing the specimens, should be placed in the lot.

As indicated above, at times it may be appropriate to combine replicates or species within a single jar; however, specimens collected from separate SAMPLING PERIODS should never be combined, as it is too easy to mix material from different periods or seasons, which may result in incorrect data or conclusions.

ATTACHMENT II

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	-	-	-	-	-	-	-		-	1	-
Streblospio benedicti	32	11	-	-	15	18	26	8		-	-	-
Asychis elongata	-	-	-	-	-	-	-	1		-	-	-
Marphysa sanquinea	-	-	-	-	-	-	-	-		2	-	-
Glycinde polygnatha	-	4	-	-	-	-	-	-		-	-	-
Eteone lighti	1	5	-	-	3	1	-	1		2	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-		-	-	-
Neanthes succinea	3	6	8	-	1	-	2	1		-	7	7
Pseudopolydora kempi	-	-	-	-	-	-	-	-		-	-	-
Polydora ligni	6	12	-	-	-	3	2	-		-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-		-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-		-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-		-	-	-
Exogone lourei	-	-	-	-	-	-	-	-		-	-	-

* Estimated numbers from the 0.5 mm sieve. Numbers not used in computations.

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-		-	-	-
Spio filicornis	-	-	-	-	-	-	-	-		-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	-	3	-	-		87	54	37
Lyonsia californica	1	-	-	-	1	-	-	-		84	300	246
Modiolus senhousia	-	-	-	-	-	-	-	-		-	8	6
Macoma inquinata	55	69	105	43	22	17	14	23		4	46	26
Macoma balthica	8	8	9	4	2	3	1	5		-	5	10
Tapes japonica	-	-	-	-	-	-	-	-		-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-		-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-		-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-		-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-		-	-	-

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FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	138	85	1	2	5	-	-	10*		-	99	19
Aoroides columbiae	1	-	-	-	5	5	3	1		1	1	-
Sarsiella spp.	-	-	-	-	-	-	-	8*		-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-		-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-		-	-	-
Balanus sp.	-	-	-	-	-	-	-	-		-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-		1	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-		-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus				650*				2500*				700*
P. gabriellae				1500*								
P. nerthoides												

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-		-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-		-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-		-	-	-

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	2	-	-	-	4	3	6	5	2	10		1
Streblospio benedicti	-	-	-	-	-	-	3	-	1	1		-
Asychis elongata	-	-	-	-	-	-	-	-	-	-		-
Marphysa sanguinea	1	2	-	-	-	-	-	-	-	-		-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-		-
Eteone lighti	-	1	-	-	-	-	1	-	3	-		-
Ammeana occidentalis	-	-	-	-	-	-	-	-	-	-		-
Neanthes succinea	-	-	-	-	2	-	2	1	3	3		1
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	-		-
Polydora ligni	-	-	-	-	-	-	-	-	-	-		-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-		-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-		-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-		-
Exogone lourei	-	-	-	-	-	-	-	-	-	-		-

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-		-
Spio filicornis	-	-	-	-	-	-	-	-	-	-		-
BIVALVIA												
Gemma gemma	14	47	49	14	51	89	81	46	8	21		45
Lyonsia californica	6	15	8	-	102	96	60	57	37	29		40
Modiolus senhousia	-	-	-	-	14	23	5	3	25	16		34
Macoma inquinata	44	49	39	-	-	11	-	-	5	7		3
Macoma balthica	9	4	4	-	2	2	1	1	2	2		1
Tapes japonica	-	-	-	-	-	-	-	-	-	1		-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-		-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-		-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-		-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-		-

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FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	12	14	5	-	-	-	-	31	6	3		5
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-		-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-		-
Caridea (fragment)	-	-	-	-	-	-	1	-	-	-		-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-		-
Balanus sp.	-	-	-	-	-	-	-	-	-	-		1
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-		-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-		-
OLIGOCHAETEA												
Peloscolex apectinatus	448*						424*		104*			
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-		-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	1		-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-		-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	1	-	-	-	1	-	-		-	2	2	-
Streblospio benedicti	8*	24*	16*	4*	5	2	-		-	8*	-	-
Asychis elongata	-	-	4	-	5	9	-		8	6	6	4
Marphysa sanguinea	2	6	-	2	5	2	-		-	-	-	-
Glycinde polygnatha	3	-	-	1	1	-	-		4	2	4	2
Eteone lighti	-	-	-	-	-	-	3		-	-	-	-
Amaeana occidentalis	2	-	-	-	-	-	-		-	-	-	-
Neanthes succinea	-	-	-	-	1	-	7		-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-		-	-	-	-
Polydora ligni	-	-	-	-	-	-	-		-	4*	-	-
Chaetozone sp.	-	-	-	-	-	-	-		-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-		1	1	2	1
Harmothoe imbricata	-	-	-	2	-	-	-		-	-	-	-
Exogone lourei	1	4*	8*	6*	4*	-	-		-	8*	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-		1	-	-	-
Spio filicornis	-	-	-	-	-	-	-		-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	1	-	25		13	5	14	15
Lyonsia californica	-	-	-	-	-	-	8		-	2	2	1
Modiolus senhousia	-	1	10	2	44	8	-		68	52	49	16
Macoma inquinata	-	-	-	-	-	-	19		1	-	-	-
Macoma balthica	-	-	-	-	-	-	6		-	-	-	-
Tapes japonica	-	3	-	2	2	-	-		1	-	-	-
Macoma nasuta	-	-	-	-	-	-	-		-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-		-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-		-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-		-	-	-	-

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FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	35*	40*	-	-	-	-	-		-	-	-	-
Aoroides columbiae	-	-	-	-	-	-	-		-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-		-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-		-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-		-	-	-	-
Balanus sp.	-	-	-	-	-	-	-		-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-		-	-	1	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-		-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	8*				264*					200*		
P. gabriellae	24*											
P. nerthoides												

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	2	-	-	2	-	-	-		-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-		63	-	16	3
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-		-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	1	5	11	2	-	9	2	2	-	5	5
Streblospio benedicti	-	8*	-	-	-	-	30*	-	-	-	40*	-
Asychis elongata	-	2	-	3	-	-	-	-	-	-	1	3
Marphysa sanquinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	-	-	-	2	4	2	2	2	-	-	-	-
Eteone lighti	-	-	-	-	-	-	-	1	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	-	1	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	1	4	-	-	1	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	6*	-	-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	1	-	-	-
BIVALVIA												
Gemma gemma	3	-	16	-	-	10	1	1	13	15	9	12
Lyonsia californica	-	-	-	53	7	7	2	12	-	-	-	-
Modiolus senhousia	17	7	11	25	5	2	1	1	31	34	20	21
Macoma inquinata	-	-	-	1	2	5	2	2	3	1	1	-
Macoma balthica	-	-	-	-	1	-	-	1	-	-	-	2
Tapes japonica	-	-	-	-	-	-	-	-	-	2	1	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	-	-	-	7	6*	-	-	-	40*	1
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus		120*					8*				80*	
P. gabriellae							24*					
P. nerthoides							1*					

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	1	6	7	2	1	-	2	2	-	-	-	-
Streblospio benedicti	-	-	24*	-	17	1	7	-	-	-	40*	1
Asychis elongata	13	1	4	5	-	-	-	-	1	-	-	-
Marphysa sanquinea	1	-	3	2	-	-	-	-	-	-	-	-
Glycinde polygnatha	1	6	7	2	-	-	1	-	-	-	-	-
Eteone lighti	-	-	-	-	1	-	4	-	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	1	-	-	-	-	-	-	4
Pseudopolydora kempi	-	-	2	1		-	-	-	-	-	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	1
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	1	-	-

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	2	-	1	-	-	-	1	-	18	21	13	10
Lyonsia californica	-	-	-	-	1	-	2	-	3	-	-	15
Modiolus senhousia	46	28	75	75	-	-	-	-	1	1	-	1
Macoma inquinata	-	-	-	-	13	3	19	6	13	10	15	30
Macoma balthica	-	-	-	-	2	-	5	-	1	2	-	5
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	1	24*	-	-	1	36	3	-	-	-	-
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus			56*				424*				200*	
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	1	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	15	-	-	-	-	-	18	26	30	5	37
Streblospio benedicti	-	-	24*	-	-	-	8*	2	110	15	-	36
Asychis elongata	15	4	-	3	-	-	-	-	10	15	-	10
Marphysa sanguinea	2	4	-	-	-	-	-	-	-	1	2	-
Glycinde polygnatha	-	1	-	-	-	-	-	-	-	3	-	-
Eteone lighti	-	-	-	-	-	-	-	-	2	3	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	1	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	5	5	-	4
Polydora ligni	-	-	-	-	-	-	-	1	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	1	1	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	8*	-	-	-	-	-

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	2
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	37	24	-	229	109	210	94	104
Lyonsia californica	-	-	-	-	-	-	1	2	149	158	14	106
Modiolus senhousia	13	13	24	19	9	-	8	30	6	5	-	-
Macoma inquinata	1	-	-	-	-	-	-	2	7	11	1	10
Macoma balthica	-	-	-	-	-	-	-	-	1	-	-	3
Tapes japonica	1	1	-	1	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	3	2	-	5	-	-	-	-

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	10*	8*	24*	-	-	-	-	-	25	42	-	29
Aoroides columbiae	-	1	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	1	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	1	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	8*						80*					500*
P. gabriellae	10*											
P. nerthoides												

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	1	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	25	47	52	30	27	39	53	38	11	15	33	14
Streblospio benedicti	4	8	9	2	-	2	-	2	-	1	-	19
Asychis elongata	2	1	-	2	2	4	7	3	4	-	5	-
Marphysa sanquinea	-	-	-	-	-	1	-	-	-	1	-	-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	-	3	4	3	1	3	4	6	3	-	2	5
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	1	-	3	-
Pseudopolydora kempi	-	3	40	1	-	2	1	2	-	-	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	2	-	1	-	2	-	3	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	1	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	101	160	66	102	12	9	8	10	80	17	195	140
Lyonsia californica	98	77	65	74	3	2	1	5	15	13	24	16
Modiolus senhousia	-	-	-	-	-	2	-	-	24	-	-	-
Macoma inquinata	19	26	23	22	15	15	4	15	5	14	10	6
Macoma balthica	-	-	2	-	4	1	2	4	-	1	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	9	16	-	50*	-	3	10	-	23	-	4	316
Aoroides columbiae	-	3	-	-	-	-	1	-	-	-	1	7
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	4	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus				500*				500*				500*
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	8	4	1	4
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	19	5	8	17	2	4	3	-	2	-	2	2
Streblospio benedicti	4	-	4	10	-	-	4*	-	8*	-	4*	-
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanquinea	-	-	-	-	13	7	6	9	3	3	2	3
Glycinde polygnatha	40*	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	2	1	1	6	-	-	-	-	-	-	-	-
Amaeana occidentalis	-	-	-	-	5	22	1	3	3	7	9	10
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	1	-	-	-	-	-	-	-	-
Polydora ligni	1	1	2	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	1	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	16	12	15	12	-	-	-	-	-	-	-	-
Lyonsia californica	-	-	1	-	-	-	-	-	-	-	-	-
Modiolus senhousia	-	1	-	-	-	-	-	-	-	-	-	-
Macoma inquinata	3	10	6	7	-	-	-	-	-	-	-	-
Macoma balthica	4	3	4	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	1	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	22	5	41	41	-	-	-	-	-	1	-	-
Aoroides columbiae	-	-	-	2	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	**	-
OLIGOCHAETEA												
Peloscolex apectinatus	81*					20*			92*			
P. gabriellae						108*						
P. nerthoides												

** colony

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	2	18	19	-	14	2	8	28	1	4	3	2
Streblospio benedicti	-	56*	-	-	80*	2	-	4	24*	-	-	-
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanquinea	-	-	-	-	-	-	-	1	10	7	10	6
Glycinde polygnatha	-	-	-	-	24*	-	-	-	-	5	3	2
Eteone lighti	-	1	-	-	-	1	4	2	-	-	-	-
Amaeana occidentalis	-	-	-	1	-	-	-	-	3	-	-	-
Neanthes succinea	-	4	2	3	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	1	-	-	-	-	-	-
Polydora ligni	-	-	-	-	-	1	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	1	1	-	2
Exogone lourei	-	-	-	-	-	-	-	-	1	-	50*	-

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	17	80	2	21	17	8	7	11	-	-	-	-
Lyonsia californica	14	48	1	33	6	7	14	3	-	-	-	-
Modiolus senhousia	48	56	-	84	18	31	52	21	1	-	-	-
Macoma inquinata	3	1	-	-	13	19	15	12	-	-	-	-
Macoma balthica	-	-	-	-	1	2	1	1	-	-	-	-
Tapes japonica	-	1	-	-	-	-	1	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	1
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	73	145	-	14	68	21	102	50	-	-	1	-
Aoroides columbiae	1	-	-	-	2	-	4	6	-	-	1	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	1	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	**	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus		112*				100*			8*			
P. gabriellae									56*			
P. nerthoides												

** colony

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	2	-	-	-	-	-	-	-	-	-	-	1
UROCHORDATA												
Ciona intestinalis	3	3	-	4	-	1	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	9	9	6	27	3	11	4	4	43	27	18	22
Streblospio benedicti	100*	-	-	-	150*	-	-	-	3	1	-	12
Asychis elongata	2	1	1	-	6	5	19	7	5	5	6	-
Marphysa sanquinea	5	3	3	6	-	1	-	-	3	2	3	3
Glycinde polygnatha	1	2	-	1	4	-	2	2	3	1	3	2
Eteone lighti	-	-	-	-	-	-	-	1	1	-	-	1
Amaeana occidentalis	7	6	2	4	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	2	2	-	1
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	1	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	2	-	1	1
Nephtys caecoides	-	-	-	-	1	1	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	14*	-	-	-

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	1	-	-	-	-	10	17	-	7
Lyonsia californica	-	2	2	-	-	1	-	1	15	20	1	3
Modiolus senhousia	12	4	4	7	85	47	74	61	10	14	-	5
Macoma inquinata	-	-	-	-	1	-	1	-	-	1	-	3
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	1	2	-	2	1	3	1	-	-	-	-
Macoma nasuta	-	-	-	-	1	1	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	1	-	-

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FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	30	-	45	-	115	67	107	54	102	24
Aoroides columbiae	-	-	-	-	-	-	-	-	5	6	-	1
Sarsiella spp.	-	-	-	-	-	-	-	-	21*	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-		-	1	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	1	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	100*				150*				104*			
P. gabriellae									64*			
P. nerthoides												

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	1	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	2	-	5	2	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	1	-	-

SOUTH BAY BENTHIC BASELINE SAMPLES: AMPHIPODA

Sample #	Date	Species	# Individuals
11	9/1/75	Ampelisca milleri	16
1	"	" "	2
13	"	" "	13
1B	10/4/75	" "	7
4A	"	" "	10
4B	"	" "	13
4C	"	" "	3
1A	"	" "	115
1B	"	" "	65
1C	"	" "	1
1D	"	" "	2
6A	"	" "	5
6B	"	" "	7
6D	"	" "	3
5D	"	" "	35
11B	"(?)	" "	9
2A	"	" "	8
		Microdeutopus schmitti	8
2B	"	" "	9
2C	"	" "	3
		Ampelisca milleri	3
2C(D?)	"	" "	1
3C	"	" "	40
3D	"	" "	17
12D	"	Ampelisca milleri	1
13B	"	" "	1
14C	"	" "	44
14D	"	" "	6

Sample #	Date	Species	# Individuals
18A	10/18/75	Microdeutopus schmitti	1
		Ampelisca milleri	31
18B	"	" "	42
18D	"	" "	30
19A	"	" "	12
19B	"	" "	15
19B(?)	"	" "	5
20B	"	" "	3
20C	"	" "	13
20D	"	" "	10
		Microdeutopus schmitti	1
21A	"	" "	20
21B	"	" "	10
21C	"	" "	5
		Microdeutopus schmitti	1
21D	"	" "(?)	9
		Ampelisca milleri	40
22A	"	" "	22
22B	"	" "	8
22C	"	" "	44
22D	"	" "	42
		Microdeutopus schmitti	2
24B	"	Ampelisca milleri	1
25A	"	" "	65
25B	"	" "	100
25D	"	" "	14
26A	"	" "	70
26B	"	" "	20
26C	"	" "	65
		Microdeutopus schmitti	6
26D	"	" "	5

Sample #	Date	Species	# Individuals
		Ampelisca milleri	37
27C	10/18/75	" "	1
28C	"	" "	18
		Corophium ascherusicum	1
29A	"	*Ampelisca milleri*	49
29C	"	" "	65
		Corophium ascherusicum	1
29D	"	*Ampelisca milleri*	61
30A	"	" "	65
		Microdeutopus schmitti	6
		Corophium ascherusicum	1
30B	"	*Ampelisca milleri*	52
		Microdeutopus schmitti	6
30C	"	*Ampelisca milleri*	6
		Corophium ascherusicum	1
30D	"	*Ampelisca milleri*	25
		Microdeutopus schmitti	2

Benthic Survey and Water Quality
Sampling Program

E. H. Smith & Associates

OCTOBER 1975 - AUGUST 1976

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SOUTH BAY DISCHARGERS AUTHORITY
BENTHIC AND WATER QUALITY SAMPLING

I. INTRODUCTION

This progress report covers data from three quarters of a four quarter study. The data from the last quarter has not been completely analyzed and, therefore, no attempt has been made to analyze all of the data from the four quarters until all the project information is available. In the second report of November, 1975 some special experiments were suggested. These experiments have been conducted and the results presented in this report. For detailed information concerning the selection of stations, sampling methodology, sieve analysis and selections of species for size class determination reference should be made to the November, 1975 progress report.

II. SUMMARY OF THE NOVEMBER 1975 REPORT

A. Methods and Materials

Thirty faunal stations were established in the South San Francisco Bay area. Four replicate samples were taken at each station for a total of 120 faunal samples. This data was analyzed and presented in the November, 1975 report.

The vessel, a 17 ft. Boston Whaler, was anchored for each station and positioned by sextant triangulation. Four replicate samples were taken using a Ponar grab. The volume of the grab is $0.055\ m^3 \pm 0.0025\ m^3$ with a surface area of $0.0504\ m^2$. Each sample was carefully placed into a plastic container and the volume measured with a calibrated ruler.

Sieving was done with a 1.0 and 0.5 mm stacked sieves. Sieved fractions were transferred to 10% buffered formalin. Prior to sorting the organisms were washed in fresh water and transferred to 70% isopropyl alchol.

A fifth grab sample from each faunal station was taken for sediment size analysis. Sediment volumes of approximately 100 g. were removed for particle size determination.

Water quality samples for laboratory analysis were collected and preserved according to the instructions given by the Pacific Environmental Laboratories (see their separate report for details). The samples were delivered to the Pacific Environmental Laboratories within six hours of collection (Standard Methods, 13th Edition, page 34). Fifteen stations with a total of 29 samples were made during the preliminary survey periods (Table I).

Deep water station samples were collected every 3 meters, starting 0.5 m below the surface. Samples were collected in PVC Niskin sampling bottles model 1010, 1.7 liter capacity. (map 1)

Field measurements include dissolved oxygen, temperature, depth, and ph. Dissolved oxygen measurements were taken with a YSI model 54 ARC oxygen meter with a 30.48 m length cable attached to a probe. Water temperature was measured with oceanographic reversing thermometers (.001 C° adjusted) attached to the Niskin collecting bottles. The ph was measured in the field with a Corning Model 610-A Expand Scale Meter. Depth was measured with a Heathkit Model MI 1030 Fathometer.

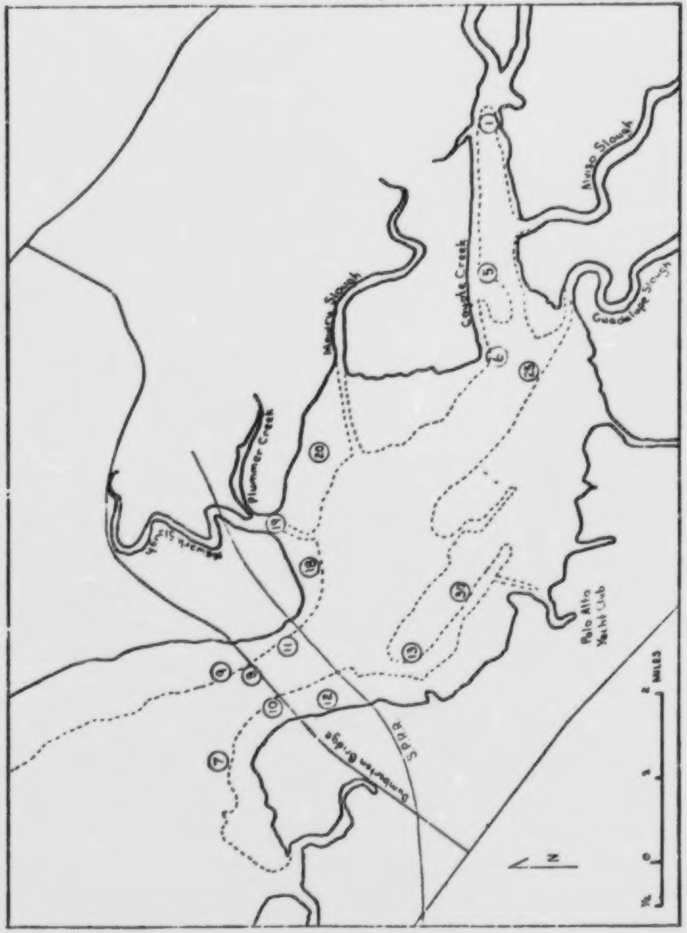
Table I

WATER QUALITY STATIONS

Sta. #	Location
A	Same as faunal station #1.
B	Same as faunal station #2.
C	Same as faunal station #3.
D	West of electrical towers in Coyote Creek, in line with the second electrical tower and the two tallest electrical towers on south side of Coyote Creek, near Guadalupe Slough entrance.
E	In Guadalupe Slough, between the electrical towers just south of NE channel marker.
F	Same as faunal station #6.
G	Same as faunal station #24.
H	Bird cage buoy in Mayfield Slough.
I	Same as faunal station #13.
J,K,L	Positioned between the two large electrical poles centered north of the car bridge, and with the salt flats.
N,M,O	Marker R14 north of car bridge.
P,Q,R	First electrical tower east of car bridge on north side of bridge.
S	North of car bridge on east side of bay, 30° to KGO radio towers, 190° to center of car bridge.
T,U,V	Halfway between car bridge and railroad bridge in the center of the channel.
W,X,Y	150 yards north of R16, south of railroad bridge.
Z,AA,BB	South of railroad bridge, in line with Aqueduct building and salt flats in east side of bay.

Map 2

Permanent Benthic Sampling Stations


Alviso Slough
Guadalupe Slough
Coyote Creek
Mowry Slough
Plummer Creek
Newark Slough
Palo Alto Yacht Club
SPRR
Dumbarton Bridge
N
MILES
0
1
2
1
5
6
24
20
19
18
11
9
8
10
12
7
13
33

B. Results

It was discovered that when additional sieving was gently done using the 0.5 fraction and the waste water sieved through 0.250 mm and 0. 180 mm sieves, that some species did pass through the 0.5 mm screen. It was proposed that additional tests be conducted based upon the design used by Reish (1959) and Hessler and Jumars (1974). These tests have been conducted and the results are presented in this report.

Sediment analysis was conducted on the samples collected during the September and October periods. A comparative study was conducted to determine the most accurate method of particle size determination for animal-sediment relationships. The results indicate that dry sieving produces mean grain sizes in the coarse or medium sand size range. Wet sieving clearing demonstrates that the particle sizes are generally skewed to the fine sand, silt and clay fractions. Wet sieving was recommended for the remaining samples. Neither wet nor dry sieving is accurate enough to determine the difference in small scale heterogeneity. Microscopic analysis is necessary to accurately relate species distribution in small areas to sediment differences. Suggested sediment analysis changes are presented in this progress report after the analysis of additional data.

The determination of permanent sampling stations and the selection of representative species are closely related. The criteria for selecting the species which best represent the South Bay area are those species which have a high frequency of occurrence, a high mean density, and a low coefficient of variation. Based upon the data presented in the November 1975 report the representative species selected were: the bivalves *Gemma gemma*, *Lyonsie california*, *Musculus senhousia*, *Macoma inquinata* and the polychaete, *Heteromastus filiformis*. At the time of the November 1975 report the final determination of the amphipod species had not been established. However, in this report, using the above criteria, we have selected the amphipod *Ampelisca milleri*.

Some of the permanent sampling stations were chosen according to the distribution of representative species within each of the thirty preliminary stations. Only those stations where each of the representative species occurred in three or more replicates are listed. The requirements for determining these permanent sampling stations based on the established representative species information were: 1) enough individuals present so that changes in the population densities would not eliminate the population, and 2) a low coefficient of variation that will enable minor population fluctuations to be more easily noticed.

The permanent stations selected are described in Table II and illustrated on map 2. From a total of 30 stations, only the selected eight stations will provide any meaningful data on animal populations. The remaining seven stations were selected because of their location to the project, i.e., near the diffuser discharge point or because they were representative of major sediment classes.

The efficiency of the Ponar grab (0.05 m^2) to collect sufficient abundance data was analyzed. It was found that four replicates would yield a more accurate analysis of the representative species. A volume of 3.0 liters was found to be the minimum recommended to maintain sufficient animal densities per grab.

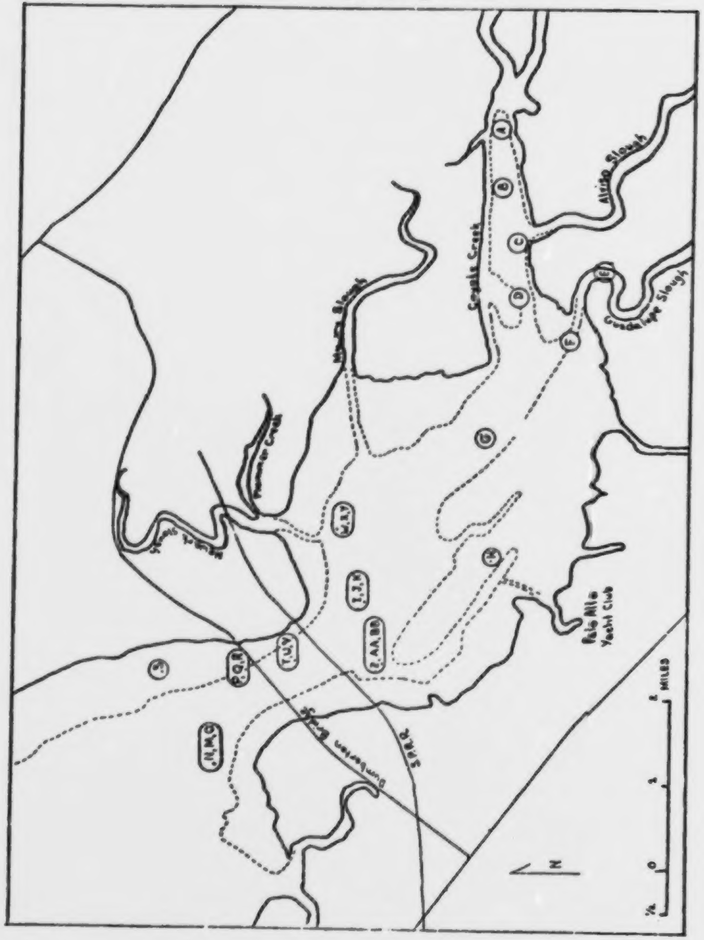
Table II

Benthic Faunal Stations

Sta. #	Location
1	50 yards south of platform in Coyote Creek.
5	In Coyote Creek, in line with the second tower in Coyote Creek and the Zeppelin hangar at Moffet Field.
6	In line with marker R20, second electrical tower in Coyote Creek, and the tall towers in Guadalupe Slough.
7	One hundred yards in channel from marker R14, north of car bridge.
8	North of car bridge in channel. 18° from first and second set of electrical towers on east side and 10° from center of bridge to electrical tower and first tower on west side of bridge.
9	North of car bridge east side. In line with KGO radio towers and first electrical tower on east side of bridge.
10	In line with electrical towers on east side and second trestle on RxR bridge on east side, 26° to second electrical tower on east side of RxR bridge center and center of car bridge.
11	North of car bridge, in line with R14 marker and center of KGO radio towers.
12	50° between large electrical tower west of car bridge center and electrical tower at east shore where bridge ends, and 12° between center of RxR bridge and Aqueduct building.
13	Mayfield Slough. Next to orange buoy "G".
18	40° to salt flats, 330° to KGO radio towers.
19	60° to salt flats, 300° to KGO radio towers.
20	30° to salt flats and 150° to Moffet Field hangars.
25	Channel marker R19.
30	Between bird cage and orange buoy "G". 125° to Moffet Field, 30° to salt flats, 330° to center of RxR bridge.

Map 2

Water Quality Sampling Stations


Alviso Slough
Coyote Creek
Guadalupe Slough
Mowry Slough
Plummer Creek
Newark Slough
Palo Alto Yacht Club
Dumbarton Bridge
S.P.R.R.
A
B
C
D
E
F
G
K
L
W,X,Y
I,J,K
Z,AA,BB
T,U,V
P,Q,R
H,N,M,O
N
½ 0 1 2 MILES

Size frequency analysis of the selected eight species was demonstrated in the November 1975 report. Size distribution histograms were used to represent the age structure of the selected species. The general assumption in size distribution analysis, is that age varies linearly with size. Length and width for some species were measured and correlated.

SIEVING EXPERIMENT

The November, 1975 progress report discussed the problems in obtaining accurate estimates of species abundances when using a 0.5 mm mesh opening as the smallest sieving screen. It was proposed that an experiment be designed to examine the number of individuals that were lost through the 0.5 mm screen size. The experiment was to be similar to the design used by Reish (1959) and Hessler & Jumars (1974). Such an experiment has been nearly completed, but it differs slightly from the proposed design. The sieving experiment examines three selected problems concerned with sieving samples of benthic invertebrates to obtain accurate species abundance data. The three problems are: 1) the effect of preserving the animals before sieving, 2) the accuracy of species abundance data using a 0.5 mm screen as the smallest screen size during sieving, as done by Reish and Hessler & Jumars, and 3) the accuracy and precision of species density estimates using a core to sub-sample the larger grabs.

METHODS

Faunal samples were collected from each of two areas in South Bay on May 11, 1976. Stations 1 and 18 were chosen because of the numerous small annelids and the wide variety of species witnessed in previous sampling occasions.

Two sampling devices were used, a Ponar grab and an aluminum core for sub-sampling. The Ponar was the same grab that was used during the quarterly sampling dates. The sub-sampler had a volume of 0.000308 m^3 (308 ml), an internal diameter of 6.5 cm, and length of 9.9 cm.

Six grab samples were collected in each area. Three random sub-samples were obtained from each grab. Three grab samples were randomly selected along with their respective sub-samples, and preserved with 50% formalin before sieving. The remaining samples were subjected to "live" sieving. All samples were sieved through a series of seven, 1 sq. ft. screens with openings of 1.000, 0.787, 0.5000, 0.295, 0.249, 0.180, and 0.119 mm. Sieving was done wih filtered sea water for the samples that were "live" sieved, and with tap water for the preserved samples. After sieving, all samples were preserved in 20% formalin. The animals retained on each size fraction were placed into separate containers and enumerated. Rose Bengal was used to facilitate counting.

Two-thirds of the samples have been enumerated (Appendix VIII). There were no animals seen on the 0.119 mm screen fraction. The preliminary analysis completed to date is addressed to the first two of the three selected problems. The first problem examines the effect of preserving the animals before sieving. In two different sampling areas, the samples preserved before sieving had a significantly higher mean number of animals retained on the sieves than did the samples sieved "live" (Table III). The magnitude of difference between mean number of animals retained was more than doubled in each area. Examination of the screens during sieving showed that the live animals (particularly the annelids) would wrap themselves around the wire screen, preventing them from being rinsed into a container for preservation and counting. Two methods were considered to remove a greater number of live animals from the sieve screens. The first method was to increase the water pressure which was found to break the animals apart before rinsing them off the screens. The second method of removing the animals individually took considerable time and the success of removing annelids in one piece was very low.

TABLE III

ANIMAL RETENTION ON ALL SCREEN SIZES

Station	Sieving Treatment	
	Preserved	Unpreserved
18	$\bar{x}$ = 321.5 s = 150.15 n = 6	$\bar{x}$ = 142.5 s = 39.87 n = 6
1	$\bar{x}$ = 144.83 s = 30.35 n = 6	$\bar{x}$ = 67.0 s = 32.50 n = 6

The second selected problem questions the accuracy of using the 0.5 mm screen as the smallest sieving screen to characterize some animal populations encountered during the study. Appendix VII shows the percent of animals that were retained on each of the seven screens. The polychaetes Streblospio benedicti, Eteone lighti and three species of Oligochaetes, Peloscolex apectinatus, P. herthoides, and P. gabriellae were the dominant fauna that passed through the 0.5 mm screen in significant numbers (Table IV). Because of the time involved in separating the oligochaete species by microscopic observations of reproductive organs, the three species are listed together as oligochaetes in the sieve test experiments. For the unpreserved samples, S. benedicti had a maximum mean of 46.62% of the individuals which passed through the 0.5 mm screen. Oligochaetes attained a mean loss rate of 91.92% and E. lighti reached a 54.17% loss rate. The samples preserved before sieving have a significantly lower loss rate through the 0.5 mm screen. S. benedicti had a 27.64% rate, oligochaetes had a 47.66%, and E. lighti had a 45.48% loss rate. It is clearly evident that high percentages of fauna can be lost by using an improper screen size for sieving certain animals. Even though the samples preserved before sieving had a lower loss rate, the measured loss will seriously affect the accuracy of species abundance data by using a 0.5 mm screen as the smallest opening to characterize some species populations in the study area.

Although the data has not been completely analyzed, several important conclusions can be drawn. The animal loss through the 0.5 mm screen necessitates a closer examination of the accuracy of similarly obtained abundance data. It is quite apparent that abundance of data should be veiwed at the specie^ level in relation to sieving characteristics. Abundance of data for those species which significantly pass through the 0.5 mm screen or any other final sieving screen. should be carefully considered before being combined with the 1.0 mm screen

Table IV

Percent Number of Animals Passing Through

The 0.5 mm Screen Size

Species	Station	Sieving Treatment	
		Preserved	Unpreserved
Streblospio benedicti	18	$\bar{x}=27.69$ $s=7.45$ $n=6$ $s^2/\bar{x}=2.00$	$\bar{x}=46.62$ $s=15.52$ $n=6$ $s^2/\bar{x}=5.17$
	1	$\bar{x}=7.68$ $s=4.73$ $n=6$ $s^2/\bar{x}=2.91$	$\bar{x}=16.74$ $s=11.26$ $n=6$ $s^2/\bar{x}=7.57$
Oligochaetes	18	$\bar{x}=47.66$ $s=15.60$ $n=6$ $s^2/\bar{x}=5.11$	$\bar{x}=91.92$ $s=11.57$ $n=5$ $s^2/\bar{x}=1.45$
	1	$\bar{x}=29.32$ $s=17.24$ $n=6$ $s^2/\bar{x}=10.14$	$\bar{x}=60.18$ $s=14.29$ $n=6$ $s^2/\bar{x}=3.93$
Eteone lighti	18	$\bar{x}=45.48$ $s=12.07$ $n=6$ $s^2/\bar{x}=3.20$	$\bar{x}=54.17$ $s=45.87$ $n=6$ $s^2/\bar{x}=38.84$
	1	$\bar{x}=40.47$ $s=36.59$ $n=5$ $s^2/\bar{x}=33.08$	$x=50$ $n=1$

data for quantitative analysis. In this case, the annelids were the dominant infauna to pass through the 0.5 mm screen. Therefore, in those areas where the annelids constitute a major portion of the fauna, a sieving screen size considerably smaller than 0.5 mm is required to retain the annelid population. Another important conclusion is the effect of not preserving the faunal sample before sieving. The difference between the mean number of animals retained on all screen sizes and screen sizes from 0.5 mm and larger are quite significant. Abundance estimates made from "live" sieved data is very likely to be a gross underestimate.

The percent loss rate discussed presents a considerable error factor when analyzing the data. It must be decided whether the established error factor is acceptable. For example, S. benedicti had a maximum lossrate, or error factor of 46.62%. The question becomes, is 46.62% a significant percentage of the population not to be counted? Tables V and VI have been compiled to simply demonstrate the effect an error term might have on species abundance data. The numbers presented are not intended to be definite predictions. The data used to calculate the tables were from stations 1 and 18 of the May sampling date. The appropriate error term was used from Table IV to adjust the raw data to its corrected form. The error term used for the preserved data were used. Table V shows the effect of an error term when standardizing the raw data to numbers/m^2. Although all of the data increased proportionately, this table shows a difference in mean values at the number/m^2 level of over 5000 individuals. Table VI demonstrates the difference in magnitude between using the raw data (#/0.05m^2) and transformed data (#/m^2). Very small standard errors in the raw data will account for very large standard errors in the transformed data. When comparing data with large standard error terms, only large abundance changes will statistically be seen.

TABLE V

Effects of Sieving Error
on Abundance Estimates

Station 18 5/1/76
Streblospio benedicti
0.5 mm Sieve Fraction

Comments	Difference between means	Without Sieving Error	With Sieving Error*
Raw data-3 out of 8 subsamples counted for each replicate	34.82	$\bar{x}$ = 113.91 s = 31.26 C.I. = 133.8-94.0	$\bar{x}$ = 148.08 s = 40.64 C.I.= 173.9-122.3
Average for 4 Ponas Grabs. Multiplication factor on raw data = 8.	273.36	$\bar{x}$ = 911.28 s = 250.0 C.I. = 1,070.0-752.32	$\bar{x}$ = 1184.64 s = 325.1 C.I. = 1,391.2-970.0
Average Per square meter multiplication factor on raw data = 160.	5,467.2	$\bar{x}$ = 18,225.60 s = 5001.6 C.I. = 21,400.0	$\bar{x}$ = 23,692.80 s = 6,502.4 C.I. = 27,824.0-19,560.0

*Sieving Error = 30%, obtained from samples preserved before insieve test for station 18, for S. benedicti (Table IV).

When modifying raw data to a standardized dimension, such as a square meter, a basic assumption must be made about the spacial distribution of the fauna. That assumption is that the distribution in the grab accurately represents the distribution of the entire square meter. Our experience has shown that most infaunal distribution patterns are aggregated. Therefore, the spacial distribution in any particular square meter is not homogenous, and the distribution pattern enclosed in a Ponar grab is not necessarily the same as in a square meter. An indicator of aggregated distributions is the variance to mean ratio ($s^2/\bar{x}$). When this ratio exceeds 1.0, then aggregated distributions are indicated. With values consistently greater than 2.0, Table IV indicates aggregated distribution patterns. The effect that aggregated distribution patterns have on density estimates, especially when magnifying data to a standard dimension, is unknown. The estimated value could be considerably higher or lower than what the actual value should be. There are two ways to minimize the effects of magnifying the data to a standardized dimension: choose a smaller standard dimension, and take more samples so that the variance is minimized.

The remainder of the samples will have to be enumerated before any conclusions can be drawn as to the accuracy and precision of species density estimates using a core to sub-sample the larger grabs. The planned analysis involves a nested ANOVA (analysis of variance) as a prelude to finding the number of replications needed to detect a given "true" difference between means, and also possibly examining optimum allocation of resources which is similar to a cost analysis. These analysis, however, may not necessarily determine the number of replicates that should be taken, because statistically there is no optimum number of samples that can be taken. In general, the more samples taken, the smaller the standard error of the mean. This particularly holds true when the initial

number of samples is small and the number of samples is increased. In examining seasonal changes in species abundance, the issue for collecting abundance data is to provide errors of estimates which can then be used to determine if statistically significant changes have occurred. The number of replicate samples to be taken depends on other considerations. One is the minimal level of precision that is to be accepted. Another is the amount of time required to process the samples in relation to the frequency of sampling dates. Additional samples using the coring device may have to be made for a better determination of the number of replicates needed.

If the abundance of a species, or a group of species is important in characterizing the station or area being sampled, then the sieve size selection is very important when the organisms are small. Table VI illustrates this point as the most abundant forms at stations 1 and 18 are the small annelids. In order to characterize these stations, based upon abundance data, a smaller sieve size would be necessary. In order to increase accuracy and reduce cost of analysis, small sub-samples should be made.

The important point of the sieve test is that the sampling procedure must reflect the organism being sampled and the questions asked of the data. Two or more sampling techniques should be used in future monitoring of the South Bay area to accurately sample the various animal populations.

TABLE VI
ESTIMATED FAUNAL DENSITIES

Station	Species	Including Sieving Error 1.0 & 0.5 mm screen size	Raw Data 1.0 & 0.5 mm screen size
1	*Streblospio benedicti*	8091/m^2	394/grab
	Oligochaetes	13,260/m^2	513/grab
	Macoma inquinata	290/m^2	16/grab
18	*Streblospio benedicti*	25,597/m^2	101/grab
	Oligochaetes	1,666/m^2	57/grab
	Eteone lighti	2,449/m^2	110/grab
	Heteromastus filiformis	1,035/m^2	52/grab
	Gemma gemma	9.5/m^2	47/grab
	Macoma inquinata	40/m^2	2/grab

QUARTERLY DATA

FIELD DATA

Faunal, sediment particle size, water quality field data and tidal heights for the first through third sampling periods are summarized in appendicies I-V. The faunal list is composed of those animals retained on the 1.0 mm screen size. All data was collected in the same manner as previously described in the November, 1975 report.

The 0.5 mm fractions are presently being processed (Appendix VIII). Each of the 0.5 mm fractions are sub-divided prior to counting for two reasons: high abundances of animals and the amount of sediment and organic matter in some of the samples, can be so great that attempts to enumerate the entire sample was not practical. In some cases, initial estimates of *Streblospio benedicti* and oligochaetes exceeded 10,000 per m^2. Therefore, each fraction is sub-divided into eight sub-samples using a modified sediment splitter. Preliminary analysis showed that the splitter divided a full sieve fraction into eight nearly equal sub-samples. The analysis consisted of repeatedly splitting the same set of samples, and counting the animals in all sub-samples. The design of the splitter is such that the full 0.5 mm fraction is randomly divided in eight sub-samples in a two-step operation; first dividing the sample in half, then dividing each half into quarters. Since the preliminary tests showed eight nearly equal sub-samples, two were chosen from each 0.5 mm fraction for enumeration.

Table V illustrates the problem of analyzing the 0.5 mm sieve fraction from some stations in South Bay. In order to characterize some of the soft substrate stations where small annelids are the most abundant, a smaller sieve size should have been used. The 0.5 mm sieve fraction may have a range of error of 7 to 92%, therefore, counts will not be accurate. Assuming a 30% error, as shown in one-test site, out of 911 estimated individuals retained on a 0.5 mm sieve, 273 will have gone through the sieve. The question now remains, is a 30% or more error an acceptable level of accuracy for determining change in a population? It would be our recommendation that the 0.5 mm sieve fraction be analyzed on a presence or absence basis, and the sieve size adjusted (.249 mm) if a monitoring program is to continue in the South Bay area.

SIZE CLASS ANALYSIS

Measurement of the four selected bivalves for size class analysis are complete to date. Length - frequency diagrams for bivalves are shown in Appendix VI. The diagrams for *Gemma gemma* (Figs. 1 - 3) clearly shows the size class increases throughout the 3 sampling periods. These figures indicate that *G. gemma* reproduces in late summer or early fall because of the increased percentage of small size classes in October, and the near absence of small size classes in May. The *Macoma inquinata* diagrams (Figs. 4-5) shows some size differences between stations 1 and 19. Station 19 (Fig. 5) clearly shows recruitment in the fall, and a gradual increase in size or growth into spring. Station 1 (Fig. 4), however, does not show fall recruitment or any substantial size increases. There could be a number of reasons for this. The environmental and/or biotic factors affecting *M. inquinata* are substantially different between station 1, Coyote Creek, and station 19, Mowry Slough entrance. Therefore, we may be dealing with two independent populations of *M. inquinata*. A second explanation might be that extensive migration and emigration is occurring in station 1 from outside areas, thereby affecting size class determination of only the population at station 1. The *Musculus senhousia* and *Lyonsia californica* decreased so much in January and May that detailed information on growth rates is not available.

In order to minimize the encountered problems in interpreting size class analysis a separate sampling program should be designed for collecting animals only for size class analysis, sex ratio determination and selected morphological study. This type of sampling program would not require replicate sampling or any particular sampling device. One main requirement would be to simply collect enough animals so that size class and other determinations could be made. There is no statistically optimum minimal number of individuals to collect. A minimum is chosen based on the time it takes to collect, measure and dissect the individuals. Our experience has shown that at least 50 individuals should be measured on each sampling data. The problems in interpreting the *Macoma* data could be answered by sampling more frequently. More frequent sampling dates would show more detail, if a species does have different reproduction times and growth rates in different areas. Also, frequent sampling dates would greatly decrease the possibility of missing an entire reproductive cycle for species with rapid developmental periods, or recruitment times for those species with continual spawning.

The polychaete, *Heteromastus filiformis*, and the amphipod, *Ampelica milleri*, have not yet been measured due to difficulties in obtaining accurate measurements. The typical size measurement for polychaetes is the number of setigers. However, only the May samples have any number of whole polychaetes. Therefore, a variety of anterior measurements regressed to the number of setigers will be made. If any of the regressions are significant, then the remaining polychaetes can be measured for size class determination. Similar difficulties are found with *A. milleri*. Partial and badly bent bodies make length measurements unreliable. Similar regressions will have to be made before the amphipods can be measured.

For impact analysis, additional information would be important to collect on the selected species. Feeding types and substrate relationships would be important information not only for possible prediction of change due to stress, but to relate species abundance fluctuations to nature or man-made changes.

COMMENTS ON THE MONITORING PROGRAM

The baseline study now in progress has been designed to describe seasonal changes in several aspects of population biology of selected species from South San Francisco Bay. A continuing monitoring program offers the opportunity to answer selected questions concerning the major species, and to obtain more detailed information as to the biotic and physical factors affecting these populations.

Although all the data has not been analyzed, based upon current experience, a number of suggestions can be made to improve the monitoring program.

1) Sample for and enumerate only the selected species at each of their respective stations. This will allow more samples to be taken for approximately the same cost. The samples could then be taken more frequently and/or more replicates taken, depending on which is needed for each species. A presence or absence record of the remaining species collected in the grab can be made. These observations will bring attention to the possible influx of large numbers of a species not originally selected from the preliminary study criteria. The sampling program could then be changed, if necessary, to follow the influx of a species not originally selected for in-depth study.

2) To use the appropriate sampling techniques for the various species. For example, in areas where the fauna is largely composed of those species that will pass through a 0.5 mm screen, sub-sample the larger grab and use a smaller screen size (.249 mm). Several species which compose the majority of individuals at some stations in South Bay can be better sampled with devices smaller than the Ponar grab by simply increasing the number of replicates. Therefore, a greater

number of smaller samples can be taken for approximately the same cost as a few larger samples, and the level of precision is greatly increased.

3) Use a separate sampling program for obtaining individuals for size class, sex ratio and morphological analysis. The problems currently encountered in analyzing size class data can be greatly reduced by obtaining a minimal number of individuals that will yield sufficient information, and frequent sampling dates. The frequent sampling dates are a vital necessity during the first year of a study for size class analysis. Very little, if anything, is known about the reproduction, fecundity, and growth rates of the common Bay area invertebrates. Infrequent sampling dates may very well miss entire reproduction cycles.

4) In addition to wet sieving, use a technique that will determine the clay and silt content of the sediment. The majority of the sediment passed through the smallest screen available for wet sieving. Any significant changes in the sediment size composition will probably occur in the size range less than 75 microns. In order to more accurately separate the clay and silt fractions, a flotation separation and/or microscopic examination could be employed.

5) For the best retention of small annelids, preserve the samples before sieving. The sieving experiment showed an approximate 50% reduction in the total number of animals when the samples were "live" sieved.

6) The location of each faunal station was established by sextant triangulation using large and easily visable, permanent landmarks. However, in practice, the ability to return accurately to the established station under changing weather and sea conditions (i.e. fog or wind) is not very good. Therefore, we have been investigating the use of a scanning sonar system which will detect submerged markers at a distance of 500 ft. We feel that the use of the scanning sonar and a short range radar will allow much more accurate repositioning of a small vessel for long-term studies.

7) Choice of species for monitoring purposes. There are a variety of factors that should be taken into consideration when choosing individual species for long-term monitoring projects. Some of these factors to be considered for each species are the proper sampling device, screen size, frequency of sampling dates and the number of replicates, and the requirements to obtain accurate size-class information. It is unlikely that any species will ideally fit all requirements; however, many of these considerations can be met with some modification to the existing sampling design. Project cost has always been recognized as a major consideration in the overall size of biological investigations. However, cost alone is not sufficient. Many of the biotic-factors for a monitoring project can be incorporated into the project at little additional cost. By incorporating these and any other modifications not yet encountered to biologic investigation, the reliability of the data increases, and the data can be better used for comparison purposes at some future time.

FINAL DATA ANALYSIS

The overall objective for this project is to conduct a baseline study designed to describe seasonal changes in the population biology of major species of infaunal and epifaunal invertebrates. The variables measured were to include abundance, size and/or age distribution, fecundity, and recruitment.

The sampling program has been designed to obtain as accurate data as possible in all areas, particularly at the species level. The full extent of the data analysis for the final report is not yet known. The faunal data will be presented in various graphs and tables. The graphs will consist of species abundance over time, size class analysis, and any possible species-species correlations. Table will include the raw and standardized (H/M^2) faunal data benthic and water quality field data.

Any faunal community analysis will be designed to characterize the South Bay area in terms of species-species and/or species-area associations. A variety of techniques can be used for community analysis, correlations, cluster analysis, trellis diagrams, and factor analysis to name a few. However, the final results of the sieving experiment may significantly alter any planned community analysis. It is presently unknown if the analysis will be based on presence-absence or quantitative data.

Sediment data will be displayed in tabular form. Statistical analysis of sediment sizes may not be feasible with such a large portion of the sediment passing through the 75 micron screen size. It is likely that any significant changes in sediment size composition will occur in the sizes below 75 microns.

Personnel Involved or Consulted on the Project:

Dr. James Blake, Pacific Marine Station. Identification and counting of the Polychaetes.

Dr. Scott Gray, Environmental Services Section - Bechtel. Identification and counting of the amphipods.

Dr. Edmund H. Smith, E. H. Smith & Associates, Project Leader. Identification and counting of the mollusca.

Mr. David Williams, E. H. Smith & Associates. Assisted in field and laboratory work on the project.

References Cited

Hessler, Robert R., and Peter A. Jumars, 1974, Abyssal Community Analysis from replicate box cores in the central North Pacific. Deep Sea Res. 21:185-209.

Reish, Donald J., 1959. A discussion of the importance of the screen size in washing quantitative marine bottom samples. Ecology 40:307-309.

APPENDICIES I- VIII

Appendix I

Table 1

Tidal Cycle on Benthic Sampling Dates

Stations 1-17 were obtained on October 4-5, 1975. Stations 18-30 were obtained on October 18, 1975. The following is a listing of the tidal cycle:

		High Tide		Low Tide	
	Date	Time	Ht.	Time	Ht.
October 1975	10/4	1218	2.71 m	1915	[illegible] m
	10/5	1259	2.87 m	1959	0.15 m
	10/18	1205	2.49 m	1053	0.18 m
January 1976	1/24	622	2.65 m	1325	
May 1976	5/1	1400	2.19 m	851	

Appendix I cont.

Table 2

Benthic - Sampling Data

October 4, 5 and 18, 1976

			Volume - l			
Sta.	Time	Depth	A	B	C	D
1	1200	3.05 m	3.50	5	5.25	5.50
2	1245	3.05 m	2.80	2.50	2.00	2.80
3	1330	2.44 m	4	5	5	5.50
4	1700	2.59 m	3.90	4.80	5	
5	1730	0.91 m	5.25	4	3.50	
6	1820	1.68 m	3.25	3		3
7	840	9.45 m	4.90	2.50	0.70	2.50
8	930	11.89 m		1.75	3	4.75
9	1030	0.91 m	3	2.75	3	3.50
10	1110	0.91 m	4.90	3	2.40	4.90
11	1145	0.91 m	4.40	1.90	4	2.50
12	1320	0.91 m	2.50	3.50	3.60	3
13	1405	2.13 m	2.50	2	4	2.20
14	1450	3.66 m	4.50	3.50	3	2.50
15	1540	0.91 m	5.25	5	3	5
16	1615	7.32 m	4.80		4	4.40
17	1700	2.13 m		2.70	3	
18	910	1.52 m	4.90	4.90	4.20	5.50
19	925	0.91 m	3.40	4	5	5
20	955	0.91 m	3.40	4.40	4.30	5.40
21	1020	1.52 m	4.90	4.40	5.40	5.40
22	1045	1.52 m	3.40	3.40	3.90	5.30

Table 2 cont.

Benthic - Sampling Data

Sta.	Time	Depth	Volume - 1 A	B	C	D
23	1115	6.09 m	3	2.90	1.60	2.50
24	1140	7.62 m	2	2.10	1	2.20
25	1245	3.66 m	4	4.10	5.50	4
26	1305	2.13 m	3.60	4	3	4.10
27	1340	2.74 m	2	2.10	2.20	2.10
28	1400	14.94 m	4.10	3.40	4.10	4.10
29	1420	3.35 m	5.50	4.40	5.50	5.30
30	1430	1.52 m	3.40	3.40	5.40	3.60

Appendix I cont.

Table 3

Benthic - Sampling Data

1/24/76

Sta.	Time	Depth m	Volume - 1 A	B	C	D
1	1600	1.0	5	4	5	5
5	1645	1.0	5	5	5.5	5
7	930	11.38	3	2.5	3.5	2.75
8	1025	11.69	4	5	4	4
9	1000	1.0	3.5	4.5	3.5	4.0
10	1050	3.4	3.5	5.5	5.5	4.5
11	1110	1.0	4	5	5	5
12	1145	3.0	6	5	4	5
13	1205	1.0	4	4.5	4	4
18	1340	1.5	5.5	5	5.5	5
19	1400	1.0	5	5.5	5.5	5
20	1725	1.5	4	4	4	3.5
25	1710	2.2	5	4	4	4
30	1800	1.0				

Appendix I cont.

Table 4

Benthic - Sampling Data

5/1/76

Sta.	Time	Depth m	Volume - 1 A	B	C	D
1	1730	1.0	4	4	5	4
5	1750	1.0	4.5	4	4.5	4.5
6		1.0	5	5	4.5	5
7	1200	11.5	5	5	4.5	3.75
8		11.5	3	4	5	4
9	1315	1.0	3	3	3	3.5
10	1245	3.0	4	4	3.75	3
11	1410	1.0	5	4	4.5	5
12		3	5	5.5	4	5
13		1.0	4	5	3	5
18	1630	1.0	4	4.5	4	4
19	1700	1.0	5	5	5	4
20		1.0	5	5	4.75	4
25	1830	1.0	3.5	5	4.5	4
30	1905	1.0	5	5	5	4

Appendix I cont.

Table 5

Benthic - Water Quality

October 4, 5, and 18, 1975

Faunal Sta. #	D.O.	% D.O. Sat.	Temp. C°	Chlorosity mg/1	Salinity ppt.	Turbidity FTU
18				15,036	26.68	16.0
19	7.47	98.71	17.0	14,772	26.21	11.0
20	7.05	93.60	17.0	14,640	25.99	8.3
21	7.11	81.82	17.0	14,113	25.06	18.0
22	6.90	79.31	17.5	14,003	24.87	6.0
23	7.98	93.01	17.0	15,168	26.91	5.8
24	7.93	95.12	17.0	14,651	26.00	5.2
25	7.58	90.56	17.8	14,288	25.38	6.3
26	8.73	106.08	18.0	14,113	25.06	6.5
27	8.61	107.50	18.0	15,497	26.25	4.9
28			18.0			
29	9.27	113.46	17.5	14,772	27.17	7.8
30	8.56	104.90	18.1	14,794	26.25	9.0

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Turbidity was determined by the Nephelometric Method (Standard Methods, 13th edition) and reported in Formazin Turbidity Units (FTU).

Appendix I cont.

Table 7

Benthic - Water Quality

5/1/76

Sta.	D.O. ppm	%Sat. D.O.	Temp. C°	Chlorosity mg/1	Salinity ppt.	Turbidity NTU*
1	6.26	80.67	21.5	10444	18.8	
5	4.46	58.26	25.5	11611	20.9	85
6	6.47	80.22	23.8	12611	22.7	65
7	7.37	86.03	16.8	14333	25.8	50
8	7.41	89.22	16.75	14944	26.9	70
9	7.31	84.89	17.0	14888	26.8	90
10	7.89	91.27	16.5	14555	26.2	60
11	7.91	92.45	17.0	14444	26.0	90
12	7.51	90.42	17.0	14944	26.9	
13	7.34	85.90	15.5	15555	28.0	100
18	7.57	90.42	23.0	13277	23.9	
19	7.83	95.20	24.0	13055	23.5	250
20	7.52	95.61	19.0	13722	24.7	
25	6.76	81.89	24.0	13833	24.9	110
30	6.28	75.89	25.0	12500	22.5	120

*NTU - Nephelometric Turbidity Units

Appendix I cont.

Table 6

Benthic - Water Quality

1/24/76

Sta.	D.O. ppm	%D.O. Sat.	Temp. C°	Chlorosity mg/1	Salinity ppt	Turbidity FTU
1	5.7	68.67	13.5	6010	10.81	53
5	7.5	88.24	13.7	11780	20.99	29
6	8.07	93.38	11.5	12990	23.11	30
7	9.32	103.60	10.0	14795	26.26	2.0
8	8.25	91.64	9.90	14640	25.99	3.1
9	8.62	95.82	10.0	14750	26.18	15
10	8.36	92.89	10.1	14580	25.88	7.8
11	7.78	86.36	10.7	14380	25.53	3.7
12	8.30	92.18	11.5	14170	25.17	3.3
13	7.29	94.61	12.5	13550	24.09	14
18	7.36	95.58	12.5	14000	24.87	5.4
19	7.89	95.06	13.5	14170	25.17	5.5
20	6.08	73.28	11.8	13750	24.44	22
25	7.69	92.65	11.0	13700	24.35	10.1
30	8.01	97.24	10.0	13875	24.65	9.0

H-74

Appendix I cont.

Table 8

WET SIEVED ANALYSIS

SEDIMENT ANALYSIS - RAW DATA SHEET

October 4, 5, and 18, 1975

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
1	1.183	1.349	1.805	7.593	1.037	2.033	85.000
2	4.025	0.767	1.648	5.443	1.546	2.044	78.840
3	3.170	1.423	4.552	8.739	2.032	3.224	76.819
4	2.459	1.031	3.435	7.377	1.916	2.025	81.757
5	1.404	0.146	4.621	6.303	1.536	1.404	84.587
6	0.590	1.789	4.679	8.925	4.954	2.123	80.520
7	13.707	0.952	6.854	7.953	2.240	1.448	68.160
8	2.145	0.728	4.938	5.666	5.785	4.091	76.648
9	1.624	0.874	5.678	11.356	11.742	12.832	55.894
10	2.139	1.134	1.924	12.102	0.373	6.288	76.041
11	0.939	0.122	5.963	12.279	14.498	14.364	51.725
12	1.381	0.705	1.777	7.065	1.998	7.344	79.686
13	5.538	1.282	1.794	11.179	4.333	8.846	67.026
14	4.518	2.170	4.269	7.115	3.959	4.767	73.212

Table 8 cont.

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
15	0.619	0.380	2.240	5.749	0.014	3.283	85.755
16	0.803	0.233	2.279	8.691	2.487	3.316	82.191
17	-	-	-	-	-	-	-
18	2.524	1.017	6.955	6.729	1.783	2.825	78.167
19	1.929	0.261	7.741	5.103	1.705	3.199	80.062
20	1.936	1.416	11.242	7.091	1.646	1.779	74.891
21	1.566	4.530	10.542	6.164	3.486	4.968	68.744
22	3.232	0.715	1.609	7.000	2.130	3.232	82.082
23	47.157	1.711	3.889	6.412	1.698	2.461	40.094
24	43.987	14.398	5.379	5.927	0.923	1.428	25.564
25	2.510	0.363	4.730	9.504	1.741	3.424	77.728
26	8.602	1.404	5.318	5.485	1.249	2.614	75.328
27	44.953	2.361	3.723	6.850	5.008	3.204	33.900
28	2.210	1.214	10.617	6.771	2.555	3.398	73.234
29	2.509	0.271	3.743	6.387	2.929	7.459	76.702
30	6.445	0.542	2.578	8.437	5.273	5.361	71.364

Appendix I cont.

Table 9

Wet Sieved Analysis

Sediment Analysis - Raw Data Sheet

1/24/76

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
1	0.301	0.186	0.945	0.817	1.089	2.163	94.499
5	1.128	1.679	4.114	1.511	2.171	2.027	87.370
6	2.222	0.771	10.751	3.121	1.927	2.171	79.037
7	35.655	1.562	2.909	3.582	1.577	1439	53.276
8	6.921	0.197	1.899	3.292	1.815	4.755	81.123
9	5.286	0.489	0.895	4.904	4.820	0.597	83.009
10	2.210	0.513	1.654	0.428	1.670	4.835	68.719
11	0.014	0.072	1.413	1.153	1.860	15.31	80.176
12	1.962	0.276	0.124	0.290	0.373	1.670	95.274
13	2.764	0.823	0.855	1.066	1.201	5.050	88.222
18	1.147	0.110	3.112	2.216	2.892	5.313	85.209

Table 9 cont.

Sta. #	Sieve Openings (mm)						
	0.600	0.425	0.250	0.180	0.125	0.075	Less Than 0.075
19	2.099	0.049	0.852	1.358	1.605	3.222	89.580
20	5.598	0.481	1.499	1.609	1.527	8.775	80.512
25	1.108	0.539	0.404	1.392	1.602	4.430	90.525
30	23.550	1.761	6.156	2.892	0.716	1.518	63.407

Appendix I cont.

Table 10

Wet Sieved Analysis

Sediment Analysis - Raw Data Sheet

5/1/76

	.600	.425	.250	.180	.125	.75	Less Than .75
1	3.103	2.196	3.900	2.760	2.465	7.838	77.738
5	3.692	0.953	4.459	2.091	2.888	9.263	78.378
6	1.452	2.424	5.747	3.359	2.891	4.535	79.592
7	2.744	2.409	2.369	8.125	5.488	2.329	76.536
8	1.959	3.929	14.480	7.446	6.198	5.407	60.579
9	14.456	1.843	13.854	4.914	8.391	4.248	52.294
10	3.989	3.465	7.429	2.393	4.001	5.111	73.610
11	6.497	2.352	8.423	2.471	4.689	5.978	69.589
12	12.939	4.318	4.181	3.296	4.059	3.623	67.584
13	3.838	1.352	8.289	3.813	3.826	4.450	74.433
18							
19	3.328	1.177	4.113	2.721	1.632	3.493	83.536
20	.076	2.578	3.348	2.919	2.641	1.681	86.758
25	3.092	2.105	4.855	3.908	4.842	4.211	76.987
30	1.241	1.385	2.505	1.843	1.819	3.269	87.944

Appendix II

Table 1

WATER QUALITY FIELD DATA

October 17, 1976

Sta. #	Depth m	D.O. mg/l	% D.O. Sat.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
A	1.95	3.60	45.57	6.30	16,290	28.85	22.90
B	2.60	4.50	54.22	6.20	11,520	20.54	20.50
C	1.50	4.90	59.04	6.50	10,810	19.29	21.40
D	2.44	5.29	64.51	6.60	11,360	20.26	21.20
E	2.60	4.29	51.17	6.59	10,650	19.01	21.50
F	4.55	5.51	68.02	6.59	12,760	22.71	21.20
G	3.90	5.40	65.85	6.55	11,700	20.85	21.40
H	2.00	6.05	73.78	6.70	13,020	23.16	21.00
I	2.00	6.40	80.00	6.80	13,940	24.77	21.00
J	6.00	6.80	85.00	6.50	14,540	25.99	20.75
K	3.00	6.80	85.00	6.20	14,440	25.64	21.75
L	Surface	6.90	86.25	6.30	14,320	25.43	21.00
M	5.64	7.65	99.36	6.20	15,519	27.51	17.00
N	8.69	7.62	90.50	5.90	15,783	27.97	16.00
O	1.00	7.59	89.40	6.40	15,695	27.83	17.00
P	7.16	7.33	85.93	6.80	15,695	27.83	17.00
Q	4.11	7.62	89.43	6.60	15,872	28.05	17.00
R	1.00	7.04	82.43	6.90	15,607	27.67	17.00
S	0.50	8.97	108.47	7.10	15,322	27.17	17.00
T	8.67	7.72	90.61	7.10	15,827	28.05	17.00
U	5.64	7.63	89.46	7.30	15,651	27.74	17.00
V	0.5	7.66	89.46	7.40	15,376	27.27	17.00

Table 1 cont.

Sta. #	Depth m	D.O. mg/l	% D.O. Sat.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
W	10.21	7.52	92.60	7.5	15,364	27.24	17.50
X	5.64	7.51	92.60	7.6	15,431	27.36	17.50
Y	0.50	7.50	92.57	7.6	15,497	27.48	17.50
Z	7.16	7.51	92.60	7.6	15,475	27.44	17.50
AA	4.11	7.52	92.61	7.6	15,300	27.13	17.50
BB	0.50	7.52	92.61	7.6	15,387	27.29	17.50

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland and Parsons.

Appendix II cont.

Table 2

Water Quality Field Data

3/16/76

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
A	2.0	9.63	111.59	8.35	11722	21.10	15.7
B	2.3	9.48	110.49	8.39	12166	21.90	15.1
C	3.0	11.252	133.13	8.45	12277	22.10	16.0
D	3.4	10.42	122.30	8.55	12833	23.10	15.1
E	2.2	11.238	130.86	8.42	11777	21.20	16.0
F	2.5	12.05	140.94	8.6	12500	22.50	16.0
G	6.2	11.398	166.47	8.6	12777	23.0	15.5
H	2.2	13.02	149.31	8.67	12777	23.0	15.5
I	1.8	11.96	138.12	8.6	13444	24.2	15.0
J	Surface	11.06	127.71	8.4	13388	24.1	15.0
K	6.23	10.91	126.71	8.32	13888	25.0	14.3
L	8.23	10.21	118.58	8.29	13886	25.0	14.1
M	Surface	10.23	132.34	8.35	13333	24.0	15.0
N	3.15	10.01	129.83	8.35	13611	24.5	14.5
O	5.15	9.89	128.61	8.35	13888	25.0	14.5
P	Surface	10.66	123.09	8.4	13388	24.1	15.7
Q	9.3	9.74	112.73	8.37	13611	24.5	14.5
R	11.3	10.22	117.20	8.37	13777	24.8	14.3
S	Surface	10.75	122.86	8.41	13500	24.3	14.7
T	Surface	11.54	132.04	8.5	13555	24.4	14.5
U	13.9	10.32	118.35	8.39	13833	24.9	14.2
V	15.9	10.61	121.81	8.39	13888	25.0	14.2

Table 2 cont.

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Chlorinity mg/1	Salinity ppt	Temp. C°
W	Surface	11.02	127.84	8.45	13833	24.9	14.2
X	3.15	10.52	122.04	8.41	13777	24.8	14.1
Y	5.15	10.92	126.68	8.43	13777	24.8	14.2
Z	Surface	10.53	123.45	8.40	13722	24.7	14.2
AA	3.15	10.01	119.02	8.38	13888	25.0	14.1
BB	5.15	9.52	113.06	8.30	13833	24.9	14.1
CC*	Surface	10.24	118.52	8.6	13611	24.5	14.7

*Location - In line with R16 and first salt flat, next to double stakes.

Appendix II cont.

Table 3

Water Quality Field Data

7/8/76

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Clorinity mg/l	Salinity ppt	Temp. C°
A	1	4.09	53.53	8.36	8444	15.2	29.9
B	1	3.09	40.95	8.41	9500	17.1	28.9
C	1	6.87	94.50	8.18	11444	20.6	29.2
D	1	4.125	56.94	8.19	12833	23.1	29.3
E	1	4.45	58.17	8.18	11666	21.0	27.0
F	1	5.11	67.86	8.30	14111	25.4	24.2
G	1	5.68	73.05	8.21	15833	28.5	22.8
H	1	5.81	74.87	8.11	16000	28.8	21.8
I	1	6.56	82.41	8.09	17111	30.8	20.1
J	1	7.25	94.22	8.29	16722	30.1	21.2
K	8	7.30	94.87	8.25	16722	30.1	21.0
L	15	7.1	92.21	8.11	16666	30.0	20.9
M	7	6.93	90.29	8.09	15833	28.5	20.5
N	3	6.56	84.92	8.21	15277	27.5	21.0
O	1	6.47	85.24	8.30	16777	30.2	21.0
P	9	7.41	92.51	8.25	16555	29.8	20.5
Q	4.5	7.51	94.05	8.31	16833	30.3	20.5
R	1	7.32	91.61	8.23	16777	30.2	20.9
S	1.5	6.2	75.15	8.19	17222	31.0	19.5
T	1m	7.21	93.70	8.37	16722	30.1	21.2
U	9	7.39	96.10	8.31	16777	30.2	20.8
V	15	7.405	96.11	8.35	16611	29.9	20.5

Table 3 cont.

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Clorinity mg/1	Salinity ppt	Temp. C°
W	9	8.05	101.96	8.21	16722	30.1	20.9
X	4.5	8.49	107.60	8.19	16777	30.2	20.9
Y	1	7.94	101.08	8.32	17166	30.9	20.5
Z	5	7.15	89.43	8.11	16722	30.1	21.1
AA	2.5	7.0	87.50	8.35	16666	31.0	20.5
BB	1	6.98	87.54	8.34	16888	30.4	20.8
CC	1	5.46	71.26	8.2	15666	28.2	23.7

Appendix III

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	-	-	-	-	-	-	-		-	1	-
Streblospio benedicti	32	11	-	-	15	18	26	8		-	-	-
Asychis elongata	-	-	-	-	-	-	-	1		-	-	-
Marphysa sanquinea	-	-	-	-	-	-	-	-		2	-	-
Glycinde polygnatha	-	4	-	-	-	-	-	-		-	-	-
Eteone lighti	1	5	-	-	3	1	-	1		2	-	-
Amacana occidentalis	-	-	-	-	-	-	-	-		-	-	-
Neanthes succinea	3	6	8	-	1	-	2	1		-	7	7
Pseudopolydora kempi	-	-	-	-	-	-	-	-		-	-	-
Polydora ligni	6	12	-	-	-	3	2	-		-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-		-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-		-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-		-	-	-
Exogone lourei	-	-	-	-	-	-	-	-		-	-	-

* Estimated numbers from the 0.5 mm sieve. Numbers not used in computations.

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FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-		-	-	-
Spio filicornis	-	-	-	-	-	-	-	-		-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	-	3	-	-		87	54	37
Lyonsia californica	1	-	-	-	1	-	-	-		84	300	246
Modiolus senhousia	-	-	-	-	-	-	-	-		-	8	6
Macoma inquinata	55	69	105	43	22	17	14	23		4	46	26
Macoma balthica	8	8	9	4	2	3	1	5		-	5	10
Tapes japonica	-	-	-	-	-	-	-	-		-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-		-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-		-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-		-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-		-	-	-

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	115	65	1	2	8	-	3	1		-	40	17
Microdeutopus schmitti	-	-	-	-	8	9	3	-		-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	8*		-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-		-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-		-	-	-
Balanus sp.	-	-	-	-	-	-	-	-		-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-		1	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-		-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus				650*				2500*				700*
P. gabriellae				1500*								
P. nerthoides												

FAUNAL LIST

	STATION #1				STATION #2				STATION #3			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-		-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-		-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-		-	-	-

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	2	-	-	-	4	3	6	5	2	10		1
Streblospio benedicti	-	-	-	-	-	-	3	-	1	1		-
Asychis elongata	-	-	-	-	-	-	-	-	-	-		-
Marphysa sanquinea	1	2	-	-	-	-	-	-	-	-		-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-		-
Eteone lighti	-	1	-	-	-	-	1	-	3	-		-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-		-
Neanthes succinea	-	-	-	-	2	-	2	1	3	3		1
Pseudopolydora kempi	-	-	-		-	-	-	-	-	-		-
Polydora ligni	-	-	-	-	-	-	-	-	-	-		-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-		-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-		-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-		-
Exogone lourei	-	-	-	-	-	-	-	-	-	-		-

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FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-		-
Spio filicornis	-	-	-	-	-	-	-	-	-	-		-
BIVALVIA												
Gemma gemma	14	47	49	14	51	89	81	46	8	21		45
Lyonsia californica	6	15	8	-	102	96	60	57	37	29		40
Modiolus senhousia	-	-	-	-	14	23	5	3	25	16		34
Macoma inquinata	44	49	39	-	-	11	-	-	5	7		3
Macoma balthica	9	4	4	-	2	2	1	1	2	2		1
Tapes japonica	-	-	-	-	-	-	-	-	-	1		-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-		-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-		-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-		-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-		-

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	10	13	3	-	-	-	-	35	5	7		3
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-		-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-		-
Caridea (fragment)	-	-	-	-	-	-	1	-	-	-		-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-		-
Balanus sp.	-	-	-	-	-	-	-	-	-	-		1
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-		-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-		-
OLIGOCHAETEA												
Peloscolex apectinatus	448*						424*		104*			
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #4				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-		-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	1		-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-		-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	1	-	-	-	1	-	-		-	2	2	-
Streblospio benedicti	8*	24*	16*	4*	5	2	-		-	8*	-	-
Asychis elongata	-	-	4	-	5	9	-		8	6	6	4
Marphysa sanquinea	2	6	-	2	5	2	-		-	-	-	-
Glycinde polygnatha	3	-	-	1	1	-	-		4	2	4	2
Eteone lighti	-	-	-	-	-	-	3		-	-	-	-
Amaeana occidentalis	2	-	-	-	-	-	-		-	-	-	-
Neanthes succinea	-	-	-	-	1	-	7		-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-		-	-	-	-
Polydora ligni	-	-	-	-	-	-	-		-	4*	-	-
Chaetozone sp.	-	-	-	-	-	-	-		-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-		1	1	2	1
Harmothoe imbricata	-	-	-	2	-	-	-		-	-	-	-
Exogone lourei	1	4*	8*	6*	4*	-	-		-	8*	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-		1	-	-	-
Spio filicornis	-	-	-	-	-	-	-		-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	1	-	21		13	5	14	15
Lyonsia californica	-	-	-	-	-	-	8		-	2	2	1
Modiolus senhousia	-	1	10	2	44	8	-		68	52	49	16
Macoma inquinata	-	-	-	-	-	-	19		1	-	-	-
Macoma balthica	-	-	-	-	-	-	6		-	-	-	-
Tapes japonica	-	3	-	2	2	-	-		1	-	-	-
Macoma nasuta	-	-	-	-	-	-	-		-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-		-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-		-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-		-	-	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	35*	40*	-	-	-	-	-		-	-	-	-
Aoroides columbiae	-	-	-	-	-	-	-		-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-		-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-		-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-		-	-	-	-
Balanus sp.	-	-	-	-	-	-	-		-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-		-	-	1	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-		-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	8*				264*					200*		
P. gabriellae	24*											
P. nerthoides												

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	2	-	-	2	-	-	-		-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-		63	-	16	3
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-		-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	1	5	11	2	-	9	2	2	-	5	5
Streblospio benedicti	-	8*	-	-	-	-	30*	-	-	-	40*	-
Asychis elongata	-	2	-	3	-	-	-	-	-	-	1	3
Marphysa sanquinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	-	-	-	2	4	2	2	2	-	-	-	-
Eteone lighti	-	-	-	-	-	-	-	1	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	-	1	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	1	4	-	-	1	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	6*	-	-	-	-	-

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FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	1	-	-	-
BIVALVIA												
Gemma gemma	3	-	16	-	-	10	1	1	13	15	9	12
Lyonsia californica	-	-	-	53	7	7	2	12	-	-	-	-
Modiolus senhousia	17	7	11	25	5	2	1	1	31	24	20	21
Macoma inquinata	-	-	-	1	2	5	2	2	3	1	1	-
Macoma balthica	-	-	-	-	1	-	-	1	-	-	-	2
Tapes japonica	-	-	-	-	-	-	-	-	-	2	1	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	-	-	-	9	6*	-	-	-	40*	1
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus		120*					8*				80*	
P. gabriellae							24*					
P. nerthoides							1*					

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	1	6	7	2	1	-	2	2	-	-	-	-
Streblospio benedicti	-	-	24*	-	17	1	7	-	-	-	40*	1
Asychis elongata	13	1	4	5	-	-	-	-	1	-	-	-
Marphysa sanquinea	1	-	3	2	-	-	-	-	-	-	-	-
Glycinde polygnatha	1	6	7	2	-	-	1	-	-	-	-	-
Eteone lighti	-	-	-	-	1	-	4	-	-	1	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	1	-	-	-	-	-	-	4
Pseudopolydora kempi	-	-	2	1	-	-	-	-	-	-	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	1
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	2	-	1	-	-	-	1	-	18	21	13	10
Lyonsia californica	-	-	-	-	1	-	2	-	3	-	-	15
Modiolus senhousia	46	28	75	75	-	-	-	-	1	1	-	1
Macoma inquinata	-	-	-	-	13	3	19	6	13	10	15	30
Macoma balthica	-	-	-	-	2	-	5	-	1	2		5
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-		-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	1	24*	-	-	-	44	6	-	-	-	-
Aoroides columbiae	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus			56*				424*				200*	
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #13				STATION #14				STATION #15			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	1	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	15	-	-	-	-	-	18	26	30	5	37
Streblospio benedicti	-	-	24*	-	-	-	8*	2	110	15	-	36
Asychis elongata	15	4	-	3	-	-	-	-	10	15	-	10
Marphysa sanquinea	2	4	-	-	-	-	-	-	-	1	2	-
Glycinde polygnatha	-	1	-	-	-	-	-	-	-	3	-	-
Eteone lighti	-	-	-	-	-	-	-	-	2	3	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	1	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	5	5	-	4
Polydora ligni	-	-	-	-	-	-	-	1	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	1	1	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-		-	-	-	-
Exogone lourei	-	-	-	-	-	-	8*	-	-	-	-	-

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FAUNAL LIST

	STATION #16				STATION #17				STATION #16			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	2
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	37	24	-	229	109	210	94	104
Lyonsia californica	-	-	-	-	-	-	1	2	149	158	14	106
Modiolus senhousia	13	13	24	19	9	-	8	30	6	5	-	-
Macoma inquinata	1	-	-	-	-	-	-	2	7	11	1	10
Macoma balthica	-	-	-	-	-	-	-	-	1	-	-	3
Tapes japonica	1	1	-	1	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	3	2	-	5	-	-	-	-

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	10*	8*	24*	-	-	-	-	-	31	42	-	30
Aoroides columbiae	-	1	-	-	-	-	-	-	-	-	-	-
Microdeutopus schmitti	-	-	-	-	-	-	-	-	1	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	1	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	1	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	8*						80*					500*
P. gabriellae	10*											
P. nerthoides												

FAUNAL LIST

	STATION #16				STATION #17				STATION #18			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	1	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	25	47	52	30	27	39	53	38	11	15	33	14
Streblospio benedicti	4	8	9	2	-	2	-	2	-	1	-	19
Asychis elongata	2	1	-	2	2	4	7	3	4	-	5	-
Marphysa sanquinea	-	-	-	-	-	1	-	-	-	1	-	-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	-	3	4	3	1	3	4	6	3	-	2	5
Amaeana occidentalis	-	-	-	-	-	-	1	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	1	-	3	-
Pseudopolydora kempi	-	3	40	1	-	2	1	2	-	-	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	2	-	1	-	2	-	3	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	1	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	101	160	66	102	12	9	8	10	80	17	195	140
Lyonsia californica	98	77	65	74	3	2	1	5	15	13	24	16
Modiolus senhousia	-	-	-	-	-	2	-	-	24	-	-	-
Macoma inquinata	19	26	23	22	15	15	4	15	5	14	10	6
Macoma balthica	-	-	2	-	4	1	2	4	-	1	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	12	15	5	50*	-	3	13	10	-	-	-	40
Aoroides columbiae	-	3	-	-	-	-	1	-	-	-	1	7
Microdeutopus schmitti	-	-	-	-	-	-	-	1	20	10	6	9
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	4	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus				500*				500*				500*
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #19				STATION #20				STATION #21			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	8	4	1	4
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	19	5	8	17	2	4	3	-	2	-	2	2
Streblospio benedicti	4	-	4	10	-	-	4*	-	8*	-	4*	-
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanquinea	-	-	-	-	13	7	6	9	3	3	2	3
Glycinde polygnatha	40*	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	2	1	1	6	-	-	-	-	-	-	-	-
Amaeana occidentalis	-	-	-	-	5	22	1	3	3	7	9	10
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	1	-	-	-	-	-	-	-	-
Polydora ligni	1	1	2	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	1	-	-	-	-	-	-	-	-	-	-
Nephtys caccoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-		-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	16	12	15	12	-	-	-	-	-	-	-	-
Lyonsia californica	-	-	1	-	-	-	-	-	-	-	-	-
Modiolus senhousia	-	1	-	-	-	-	-	-	-	-	-	-
Macoma inquinata	3	10	6	7	-	-	-	-	-	-	-	-
Macoma balthica	4	3	4	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	1	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	22	8	44	42	-	-	-	-	-	1	-	-
Aoroides columbiae	-	-	-	2	-	-	-	-	-	-	-	-
Microdeutopus schmitti	-	-	-	2	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	**	-
OLIGOCHAETEA												
Peloscolex apectinatus	81*					20*			92*			
P. gabriellae						108*						
P. nerthoides												

**colony

FAUNAL LIST

	STATION #22				STATION #23				STATION #24			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	2	18	19	-	14	2	8	28	1	4	3	2
Streblospio benedicti	-	56*	-	-	80*	2	-	4	24*	-	-	-
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanquinea	-	-	-	-	-	-	-	1	10	7	10	6
Glycinde polygnatha	-	-	-	-	24*	-	-	-	-	5	3	2
Eteone lighti	-	1	-	-	-	1	4	2	-	-	-	-
Amaeana occidentalis	-	-	-	1	-	-	-	-	3	-	-	-
Neanthes succinea	-	4	2	3	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	1	-	-	-	-	-	-
Polydora ligni	-	-	-	-	-	1	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	1	1	-	2
Exogone lourei	-	-	-	-	-	-	-	-	1	-	50*	-

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	17	80	2	21	17	8	7	11	-	-	-	-
Lyonsia californica	14	48	1	33	6	7	14	3	-	-	-	-
Modiolus senhousia	48	56	-	84	18	31	52	21	1	-	-	-
Macoma inquinata	3	1	-	-	13	19	15	12	-	-	-	-
Macoma balthica	-	-	-	-	1	2	1	1	-	-	-	-
Tapes japonica	-	1	-	-	-	-	1	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	1
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	65	100	-	14	70	20	65	37	-	-	1	-
Aoroides columbiae	1	-	-	-	2	-	4	6	-	-	1	-
Microdeutopus schmitti	-	-	-	-	-	-	6	5	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Pyromaia tuberculata	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	1	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	**	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus		112*				100*			8*			
P. gabriellae									56*			
P. nerthoides												

** colony

FAUNAL LIST

	STATION #25				STATION #26				STATION #27			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	2	-	-	-	-	-	-	-	-	-	-	1
UROCHORDATA												
Ciona intestinalis	3	3	-	4	-	1	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	9	9	6	27	3	11	4	4	43	27	18	22
Streblospio benedicti	100*	-	-	-	150*	-	-	-	3	1	-	12
Asychis elongata	2	1	1	-	6	5	19	7	5	5	6	-
Marphysa sanquinea	5	3	3	6	-	1	-	-	3	2	3	3
Glycinde polygnatha	1	2	-	1	4	-	2	2	3	1	3	2
Eteone lighti	-	-	-	-	-	-	-	1	1	-	-	1
Amaeana occidentalis	7	6	2	4	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	2	2	-	1
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	1	-	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	2	-	1	1
Nephtys caecoides	-	-	-	-	1	1	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	14*	-	-	-

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FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	1	-	-	-	-	10	17	-	7
Lyonsia californica	-	2	2	-	-	1	-	1	15	20	1	3
Modiolus senhousia	12	4	4	7	85	47	74	61	10	14	-	5
Macoma inquinata	-	-	-	-	1	-	1	-	-	1	-	3
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	1	2	-	2	1	3	1	-	-	-	-
Macoma nasuta	-	-	-	-	1	1	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	1	-	-

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	18	-	49	-	65	61	65	52	6	25
Aoroides columbiae	-	-	-	-	-	-	-	-	5	6	-	1
Sarsiella spp.	-	-	-	-	-	-	-	-	21*	-	-	-
Microdeutopus schmitti	-	-	-	-	-	-	-	-	6	6	-	2
Pyromaia tuberculata	-	-	-	-	-	-	1	-	-	-	-	-
Corophium acherusicum	-	-	1	-	-	-	1	-	1	-	1	-
Synidotea laticauda	1	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus	100*				150*				104*			
P. gabriellae									64*			
P. nerthoides												

FAUNAL LIST

	STATION #28				STATION #29				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	1	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	2	-	5	2	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	1	-	-

Appendix IV

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	-	-	-	5	1	7	6	18	26	21	12
Streblospio benedicti	51	26	21	22	6	11	2	9	4	3	2	5
Asychis elongata	-	1	-	-	-	-	-	-	-	-	-	-
Marphysa sanguinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	8	1	-	-	18	10	16	25	17	17	17	14
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	1	-	-	1
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	-	1	-
Polydora ligni	-	-	-	1	-	-	-	1	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	1	-	-	-	18	45	25	53	22	22	18	29
Lyonsia californica	-	-	-	-	3	8	2	8	7	5	12	4
Modiolus senhousia	-	-	-	-	2	-	-	-	-	4	2	1
Macoma inquinata	23	12	28	19	2	6	11	10	2	9	10	3
Macoma balthica	2	2	6	6	-	-	1	1	-	1	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	1	1	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	1	1	-	-	10	19	9	15	33	34	63	22
Microdeutopus schmitti	-	-	-	-	1	-	1	-	-	-	5	1
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Corophium ascherusicum	-	-	-	-	-	-	-	-	-	-	2	1
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION				STATION				STATION			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	-	-	1	10	17	7	11	4	1	2	3
Streblospio benedicti	-	1	-	4	-	-	4	3	10	13	15	11
Asychis elongata	2	-	1	1	25	22	17	11	1	5	-	4
Marphysa sanguinea	5	3	4	2	1	1	1	3	-	-	-	-
Glycinde polygnatha	5	2	1	1	1	1	3	1	3	3	3	5
Eteone lighti	-	-	-	-	-	-	-	-	-	-	-	-
Amaeana occidentalis	2	1	-	1	24	33	13	9	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	1	1	3
Polydora ligni	-	-	-	-	-	1	-	1	-	2	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	1
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	2	10	1	5

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FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	1	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	-	-	-	-	-	1	1	2
Lyonsia californica	-	-	-	-	-	3	6	1	9	6	9	11
Modiolus senhousia	-	-	-	-	134	112	96	69	-	-	1	-
Macoma inquinata	-	-	-	-	1	-	1	1	1	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	1	1	-	1	1	2	2	8	1	1	-	-
Macoma nasuta	-	-	-	1	2	-	1	1	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	2	3	-	6
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	-	-	8	5	-	2	140	116	157	200
Microdeutopus schmitti	-	-	-	-	-	-	-	-	3	5	2	6
Caprella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	1	-	-	-	-	-	-	-	-
Corophium ascherusicum	-	-	-	-	1	-	-	-	-	-	2	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	1	1	1	-	-	-	-	-
ECTOPROCTA												
Bryozoa	X	X	X	X	-	-	-	-	X	-	X	X
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	1	-	2	2	-	-	-	-
CHORDATA												
Leptocottus armatus												

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	4	6	3	2	3	2	5	6	5	1	3	1
Streblospio benedicti	3	16	14	2	292	161	94	168	8	3	2	1
Asychis elongata	-	-	1	4	1	-	2	-	6	9	12	5
Marphysa sanquinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	-	3	-	1	3	1	-	-	3	3	1	2
Eteone lighti	-	-	-	-	-	-	-	2	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	3	6	2	-	1	-	1	-	-	1	-
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	5	-	-	-	-	-	-	-
Nephtys caecoides	-	-	3	2	-	4	3	1	-	-	2	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	1	1	-	-	-	-	1	-	-	-

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FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	18	3	-	46	4	-	-	-
Lyonsia californica	3	4	3	4	29	8	3	34	47	15	11	12
Modiolus senhousi	2	82	48	7	-	-	1	-	-	2	4	3
Macoma inquinata	-	2	1	-	1	-	-	1	-	1	-	2
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	1	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	1	-	1	-	1	3	1	1	-	1	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	-
Urosalpinx cinerea	-	-	1	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	7	93	29	18	11	7	7	18	89	54	76	37
Microdeutopus schmitti	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	1
Corophium acherusicum	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-		-	-	-	-	-	-	-	-	X
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	9	9	6	11	3	11	6	1	9	10	6	10
Streblospio benedicti	1	-	9	-	6	10	2	4	1	3	5	3
Asychis elongata	13	17	15	11	34	23	46	35	18	11	29	26
Marphysa sanguinea	-	2	2	-	-	-	-	-	1	-	-	-
Glycinde polygnatha	-	3	2	2	-	-	1	3	1	2	1	1
Eteone lighti	1	1	1	-	1	-	-	1	1	2	2	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	1	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	5	2	5	6	-	-	-	-	2	1	1	2
Polydora ligni			-	-	-	-	-	-	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	1	-	-	1	1	1	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	6	2	-	3	4	3	5	5
Lyonsia californica	-	-	-	-	16	9	1	12	5	2	12	10
Modiolus senhousia	-	3	1	-	1	1	3	1	2	1	2	1
Macoma inquinata	-	-	-	-	-	2	1	1	-	-	-	3
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	2	-	-	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	1	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	1	10	8	3	3	-	1	2	2
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	24	22	51	20	273	154	64	184	109	92	239	169
Microdeutopus schmitti	-	2	-	1	2	-	-	1	4	2	1	-
Caprella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Corophium ascherusicum	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	1	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	X	-	X	-	-	-	-	-	-	-	-	-
OLIGOCHAETA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	1	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	14	8	15	8	21	15	19	21	3	1	3	36
Streblospio benedicti	36	31	25	17	10	-	8	2	-	5	-	12
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	2
Marphysa sanguinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	2	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	9	11	13	12	9	6	5	10	-	-	-	10
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	1	2	1	1	-	-	-	-
Pseudopolydora kempi	13	7	2	7	-	-	-	-	-	1	-	-
Polydora ligni	-	1	3	2	-	-	-	-	-	-	-	-
Chaetozone sp.	5	8	6	4	-	-	1	-	-	-	-	-
Nephtys caecoides	-	1	-	-	-	-	-	-	-	-	-	1
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	2	-	3	1	-	-	-	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	36	33	18	14	34	19	42	58	-	2	-	4
Lyonsia californica	-	3	1	-	48	16	36	30	-	2	-	3
Modiolus senhousia	1	-	1	-	2	9	1	7	-	-	1	1
Macoma inquinata	1	2	3	4	-	3	1	1	3	-	-	10
Macoma balthica	-	-	-	1	-	-	-	-	-	-	-	1
Tapes japonica	-	-	-	-	1	-	-	1	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	1	-	-	-	-	1
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	2	-	-	-	-	-	-	-	1
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	16	19	12	12	41	44	23	26	-	149	29	281
Microdeutopus schmitti	1	-	-	2	-	-	-	-	-	-	-	1
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Corophium acherusicum	-	-	-	-	-	-	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	1	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION # 20				STATION #25				STATION#30			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

Appendix V

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	-	-	-	-	-	-	3	3	10	11	16	4
Streblospio benedicti	265	193	208	221	4	1	4	5	11	9	7	-
Asychis elongata	-	-	-	-	1	-	-	1	-	-	-	-
Marphysa sanguinea	-	-	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	-	-	-
Eteone lighti	3	5	6	2	2	1	4	6	7	3	2	11
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	-	1	2	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	-	-	-	3	1	-
Polydora ligni	1	1	1	-	-	-	-	2	5	4	4	4
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	1
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	-	-	-	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	-	-	-	-	-	-	-	-	2	-	3	1
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	19	7	19	15	31	29	18	36
Lyonsia californica	-	-	-	1	-	1	-	-	-	-	-	-
Modiolus senhousia	-	-	-	-	-	-	-	-	-	-	-	-
Macoma inquinata	13	18	11	16	6	-	1	4	6	5	3	3
Macoma balthica	1	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	1
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	2	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	2	-	1	-	29	-	15	105	51	70	29	72
Microdeutopus schmitti	-	-	-	-	-	-	-	1	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Corophium ascherusicum	-	-	-	-	-	-	-	1	-	-	-	-
Balanus sp.	-	-	-		-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #1				STATION #5				STATION #6			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	1	-	-	-	5	17	7	25	-	5	2	2
Streblospio benedicti	1	2	-	2	1	31	42	9	15	60	17	95
Asychis elongata	3	8	6	2	-	8	6	20	3	2	1	3
Marphysa sanguinea	-	-	2	2	1	-	-	-	-	-	-	-
Glycinde polygnatha	2	-	1	3	-	2	1	-	3	2	2	4
Eteone lighti	-	-	-	-	-	-	-	1	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	1	-	1	-	-	-	-
Neanthes succinea	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	-	-	-	-	-	-	1	-	-	-	-	-
Polydora ligni	-	-	-	-	-	8	-	2	-	-	-	-
Chaetozone sp.	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	1	-	1	-	-	-	-	1	1	4	2
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	1	-	3	-	-	3	-	-	-	2	3	11

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	1	-	-	-	5	-	-	2	-	-	-	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	-	-	-	-	2	4	-	20
Lyonsia californica	-	-	-	-	-	-	-	1	1	1	2	6
Modiolus senhousia	-	2	-	3	64	85	42	77	-	-	-	1
Macoma inquinata	1	-	-	1	1	3	-	1	3	1	-	1
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	1	-	-	1	5	-	4	-	1	-	-
Macoma nasuta	-	1	-	1	2	1	4	3	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	2	-	-	2	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	53	49	29	27	-	38	15	17	-	10		7
Microdeutopus schmitti	-	-	-	-	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	1	1	-	-	-	-	-	-	-	-
Corophium ascherusicum	1	-	-	-	-	-	-	-	-	-	-	-
Pagurus sp.	1	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	X	-	-	-	-	X	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #7				STATION #8				STATION #9			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	1	-	6	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	1	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	69	30	44	12	2	2	-	4	2	1	1	2
Streblospio benedicti	49	17	24	2	4	7	2	14	5	4	9	5
Asychis elongata	-	-	-	-	2	-	-	-	12	3	3	6
Marphysa sanguinea	-	1	-	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	2	2	1	-	-	-	-	1	-	1	-	-
Eteone lighti	-	-	-	-	-	-	-	-	-	-	-	-
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Eteone californca	7	1	9	-	-	-	-	-	-	-	-	-
Pseudopolydora kempi	3	-	1	-	-	1	1	-	-	-	-	-
Polydora ligni	11	2	1	3	1	-	-	1	-	-	-	-
Chaetozone sp.	1	1	-	-	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	-	-	-	1	-	2	1	-	-
Harmothoe imbricata	-	-	1	-	-	-	-	-	-	-	-	-
Exogone lourei	10	4	10	3	-	-	-	-	1	-	5	4

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FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	4	-	5	2	-	-	-	-	-	-	-	-
Haploscoloplos elongata	-	1	-	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	18	-	5	4	-	-	-	-	-	-	-	-
Lyonsia californica	-	1	-	-	-	2	1	1	8	4	3	2
Modiolus senhousia	-	-	2	1	-	-	-	-	11	3	2	5
Macoma inquinata	-	-	-	1	1	-	-	-	-	1	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	-	-	1	-	-	-	-	-
Macoma nasuta	-	1	-	1	1	1	4	5	-	-	1	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	1	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	487	84	476	706	1	1	-	7	27	28	19	29
Microdeutopus schmitti	-	-	-	2	-	-	-	-	-	-	-	-
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	1	-	-	-
Corophium ascherusicum	-	-	-	5	-	1	-	-	-	-	-	-
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	X	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #10				STATION #11				STATION #12			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	1	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	38	12	42	26	64	16	103	24	34	36	42	29
Streblospio benedicti	5	1	28	12	57	102	202	20	38	12	36	9
Asychis elongata	3	2	7	9	1	-	-	1	-	1	1	-
Marphysa sanguinea	2	2	2	-	-	-	-	-	-	-	-	-
Glycinde polygnatha	2	2	2	-	1	-	2	-	-	-	-	-
Eteone lighti	2	-	2	-	5	6	18	11	-	2	2	1
Amaeana occidentalis	-	1	-	-	-	-	-	-	-	-	-	-
Eteone californica	-	-	1	1	6	5	2	3	4	2	2	-
Pseudopolydora kempi	1	-	-	-	-	2	-	-	12	20	27	17
Polydora ligni	-	-	2	3	5	2	10	3	32	16	38	19
Chaetozone sp.	-	-	3	1	-	2	-	1	1	1	8	-
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	-	-	-	-	-	-
Exogone lourei	-	1	6	3	-	-	-	-	-	-	-	-

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FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	1	-	3	3	-	-	3	1	12	6	17	10
Haploscoloplos elongata	1	-	1	-	-	-	-	-	-	-	-	-
BIVALVIA												
Gemma gemma	-	-	-	-	97	25	22	43	23	10	11	2
Lyonsia californica	-	-	-	1	1	-	-	1	-	-	-	-
Modiolus senhousia	-	2	1	1	-	-	-	-	-	1	-	-
Macoma inquinata	-	1	-	1	3	1	-	4	13	25	24	22
Macoma balthica	-	-	-	-	1	-	4	-	-	-	-	-
Tapes japonica	-	-	-	1	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	1	1	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	2	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	48	62	123	95	4	7	11	9	3	1	-	1
Microdeutopus schmitti	-	-	1	3	-	-	-	-	-	-	-	-
[illegible]siella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea (fragment)	-	-	-	-	-	-	-	-	-	-	-	-
Corophium ascherusicum	1	2	-	1	-	-	-	-	-	-	1	-
[illegible] sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

	STATION #13				STATION #18				STATION #19			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	1	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
POLYCHAETA												
Heteromastus filiformis	3	41	4	3	16	27	24	18	49	30	34	43
Streblospio benedicti	3	173	10	33	1	6	9	-	2	8	35	121
Asychis elongata	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanguinea	-	-	-	-	-	-	-	-	2	-	-	-
Glycinde polygnatha	-	-	-	-	-	-	-	-	-	1	-	-
Eteone lighti	-	19	-	1	-	2	1	-	8	4	9	15
Amaeana occidentalis	-	-	-	-	-	-	-	-	-	-	-	-
Neanthes succinea	-	-	-	-	1	1	1	3	-	1	-	-
Pseudopolydora kempi	-	6	-	-	-	-	-	-	-	-	1	2
Polydora ligni	-	18	-	-	1	-	1	3	4	6	8	13
Chaetozone sp.	1	-	4	14	-	4	1	-	2	1	1	2
Nephtys caecoides	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe imbricata	-	-	-	-	-	-	1	-	-	2	-	-
Exogone lourei	-	1	-	-	-	-	-	-	-	-	-	3

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FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
Capitella capitata	1	4	3	1	-	-	-	-	1	-	3	17
Eteone californica	-	9	-	-	-	-	-	-	1	2	1	1
BIVALVIA												
Gemma gemma	-	1	-	110	23	24	13	10	5	4	21	2
Lyonsia californica	-	1	-	1	9	9	9	7	1	-	1	-
Modiolus senhousia	-	-	-	-	12	-	3	27	1	1	5	-
Macoma inquinata	12	8	9	10	4	1	3	3	2	-	3	5
Macoma balthica	-	-	-	-	-	-	-	-	-	-	-	-
Tapes japonica	-	-	-	-	-	-	-	-	-	-	-	-
Macoma nasuta	-	-	-	-	-	-	-	-	-	-	-	-
Ostrea lurida	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA												
Nassarius obsoletus	-	-	-	-	-	-	-	-	-	-	-	2
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-

FAUNAL LIST

	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
ARTHROPODA												
Ampelisca milleri	-	-	-	7	27	5	23	6	228	745	224	1234
Microdeutopus schmitti	-	-	-	-	2	-	1	1	3	7	3	16
Sarsiella spp.	-	-	-	-	-	-	-	-	-	-	-	-
Caridea	-	-	-	-	1	2	-	-	-	-	-	-
Corophium acherusicum	-	-	-	-	15	-	2	-	2	9	3	27
Balanus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Synidotea laticauda	-	-	-	-	-	-	-	-	-	-	-	-
ECTOPROCTA												
Bryozoa	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETEA												
Peloscolex apectinatus												
P. gabriellae												
P. nerthoides												

FAUNAL LIST

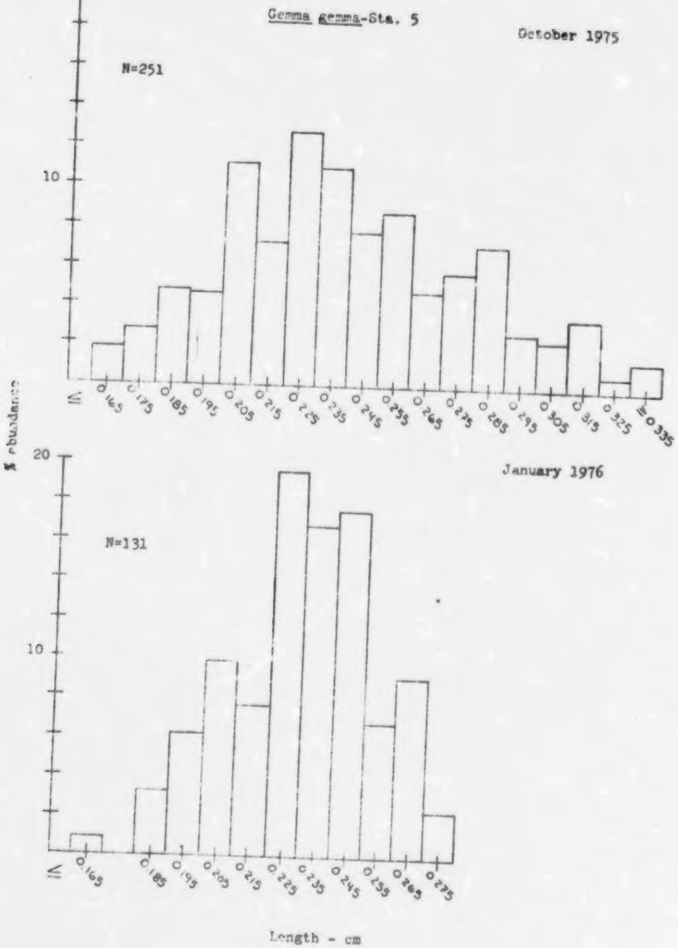
	STATION #20				STATION #25				STATION #30			
	A	B	C	D	A	B	C	D	A	B	C	D
CNIDARIA												
Stylatula elongata	-	-	-	-	-	-	-	-	-	-	-	-
UROCHORDATA												
Ciona intestinalis	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA												
Leptocottus armatus	-	-	-	-	-	-	-	-	-	-	-	-

Appendix VI

Length-Frequency Diagrams

Figs. 1 through 10

Fig. 1



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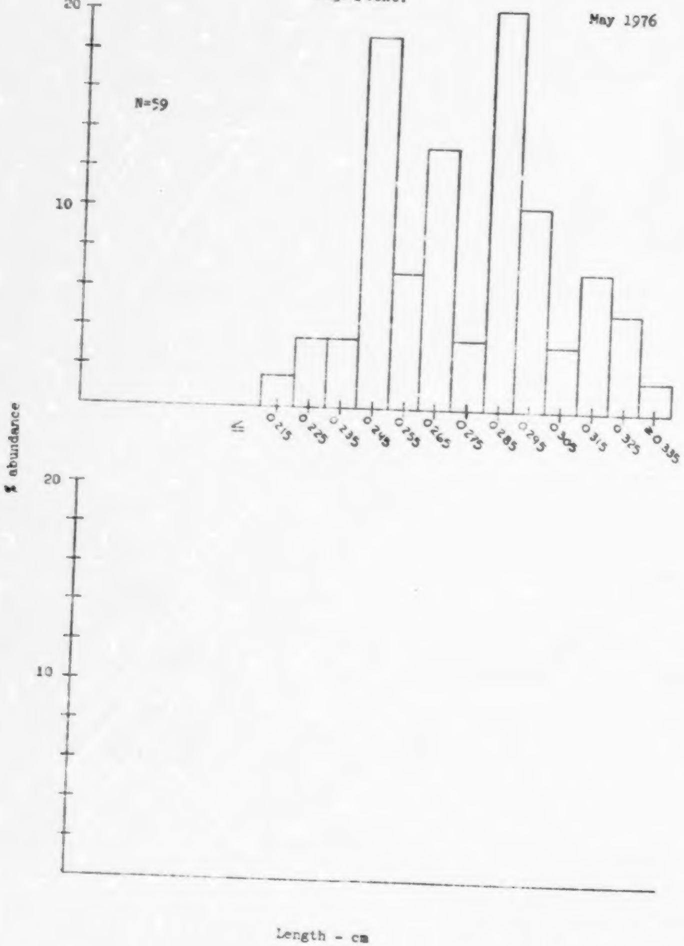
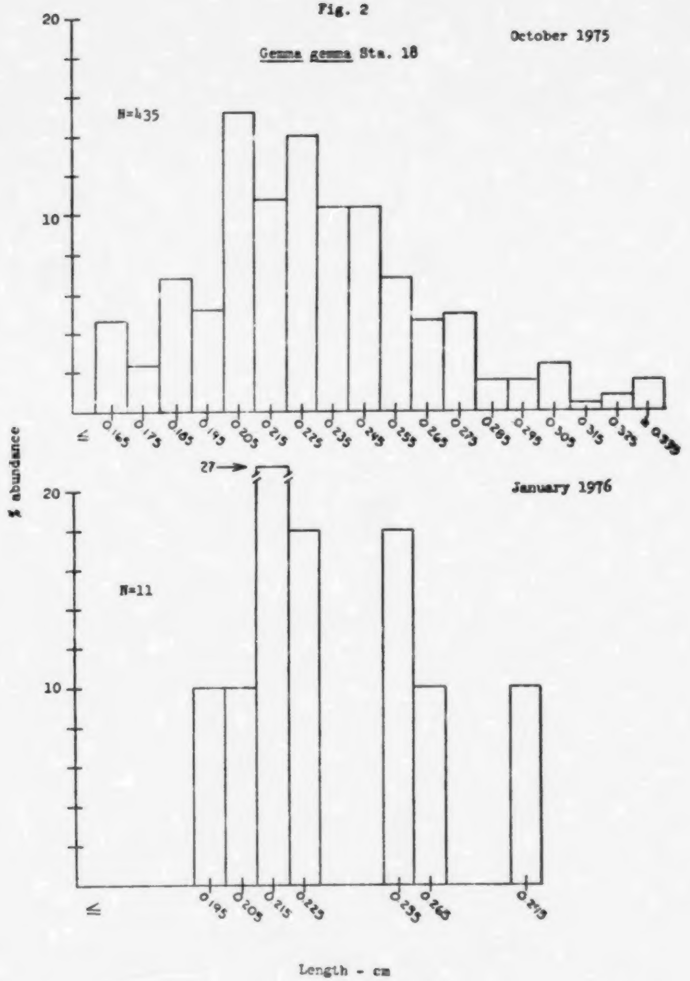


Fig. 2



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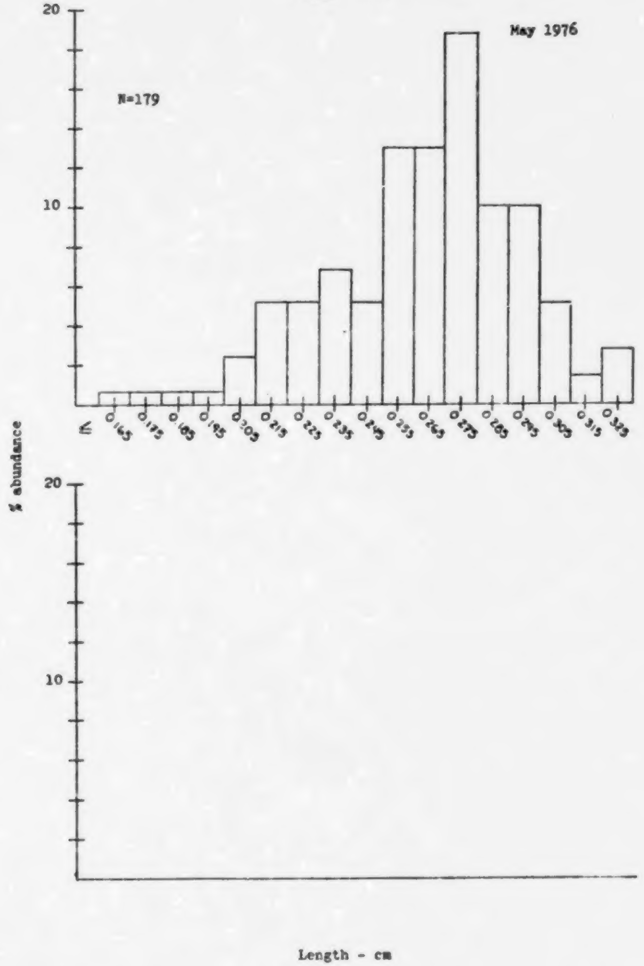


Fig. 3

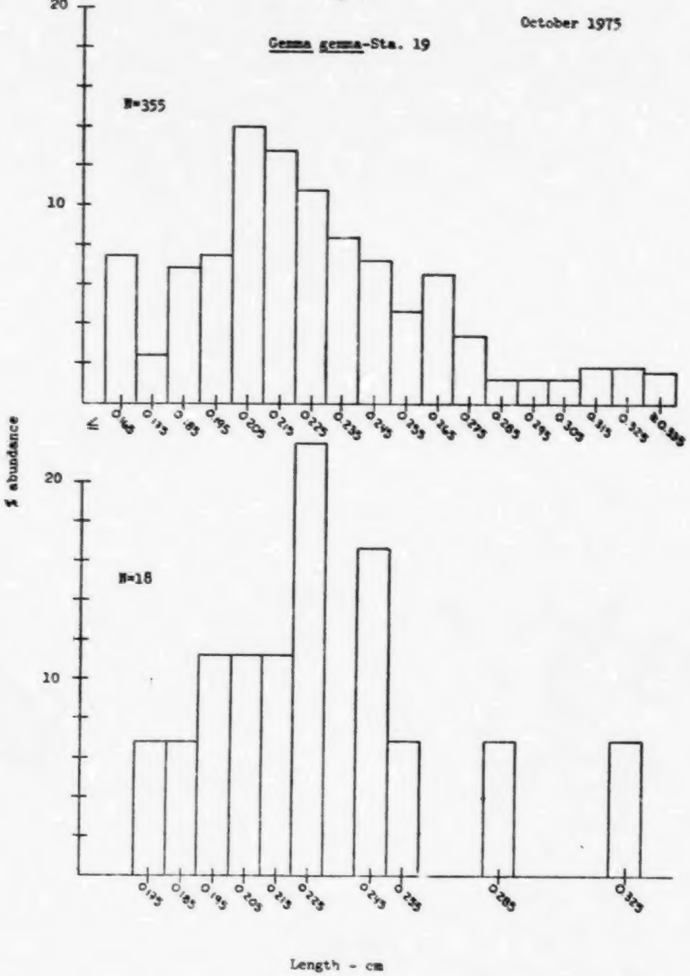


Fig. 3 cont.

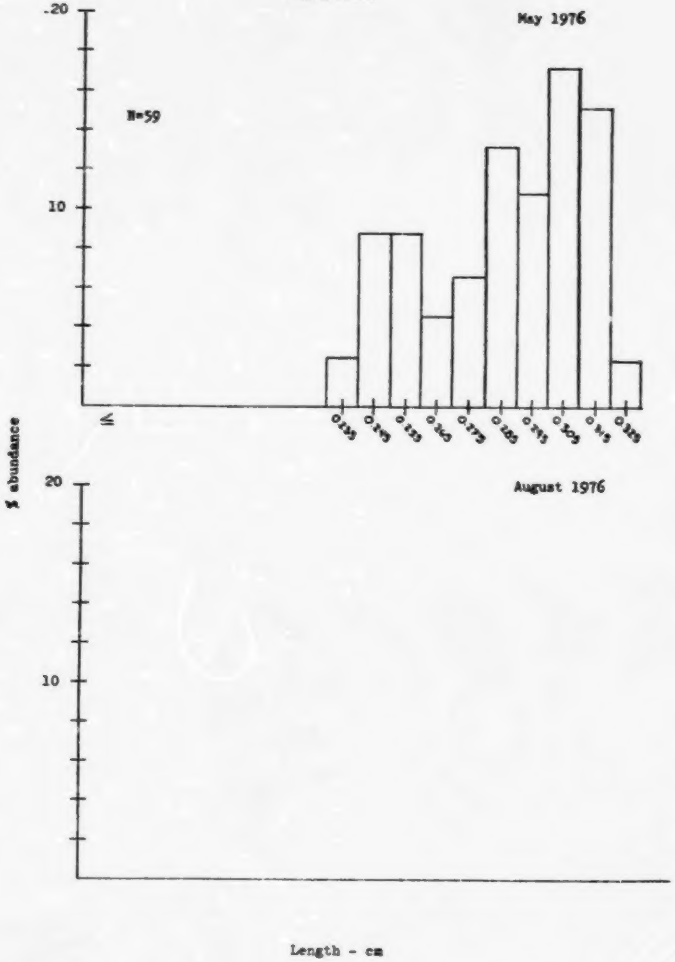
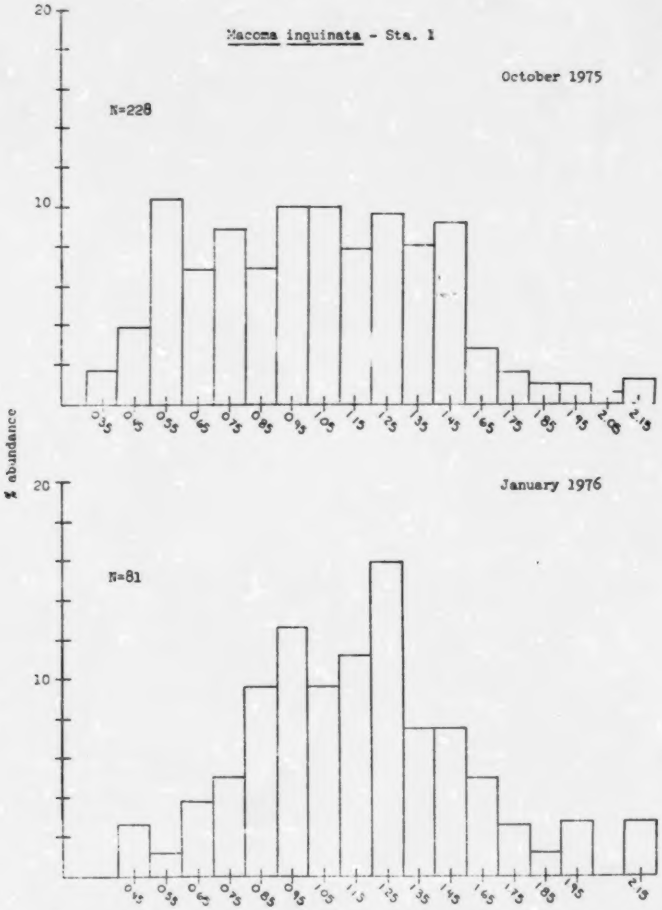


Fig. 4

Macoma inquinata - Sta. 1



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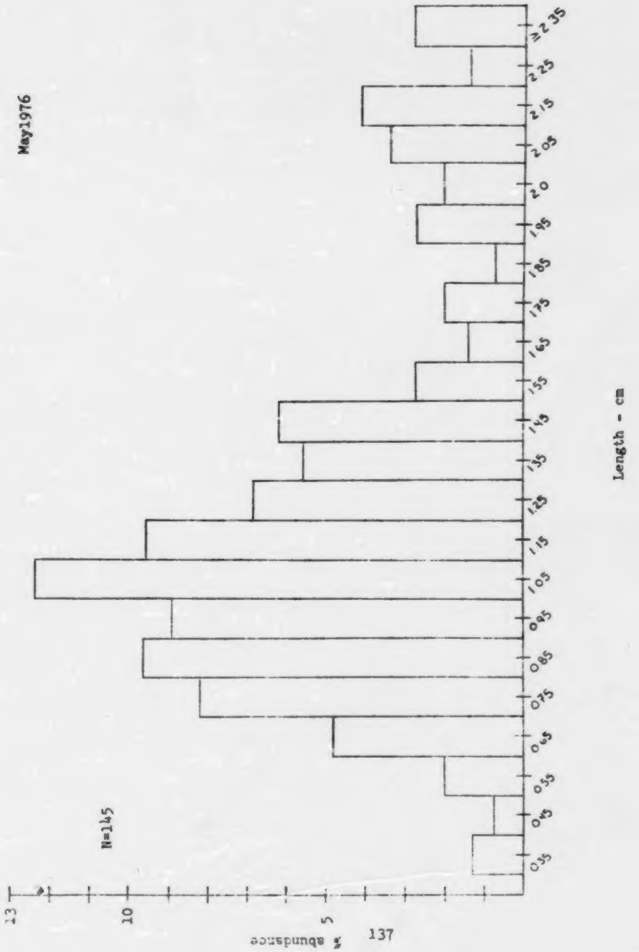
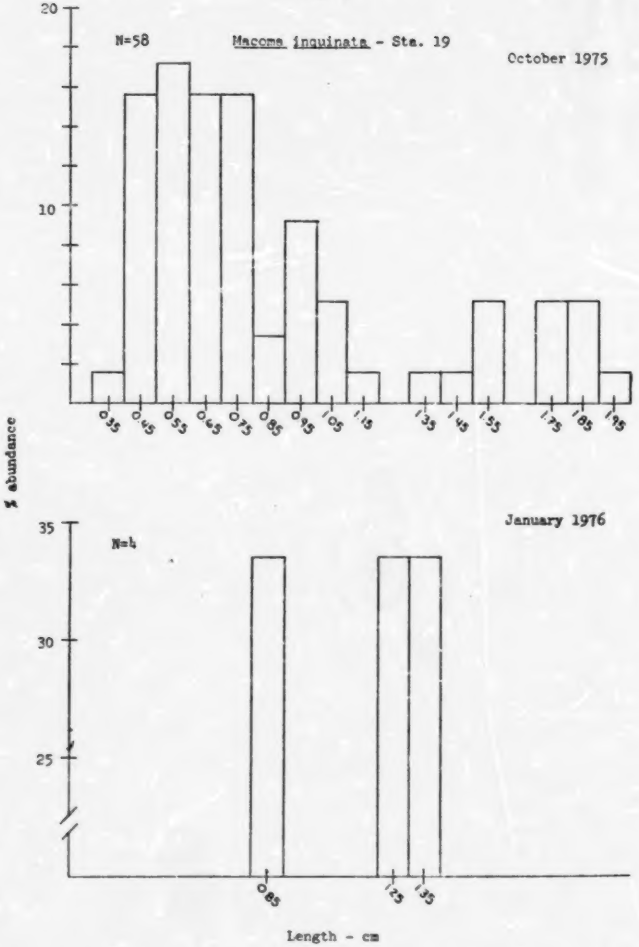


Fig. 5



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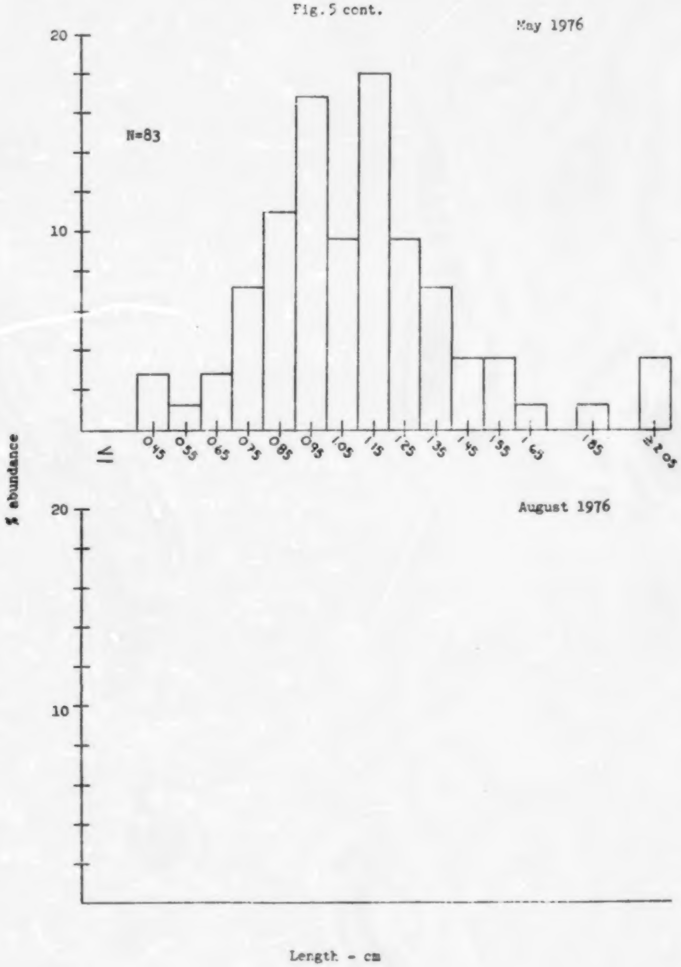

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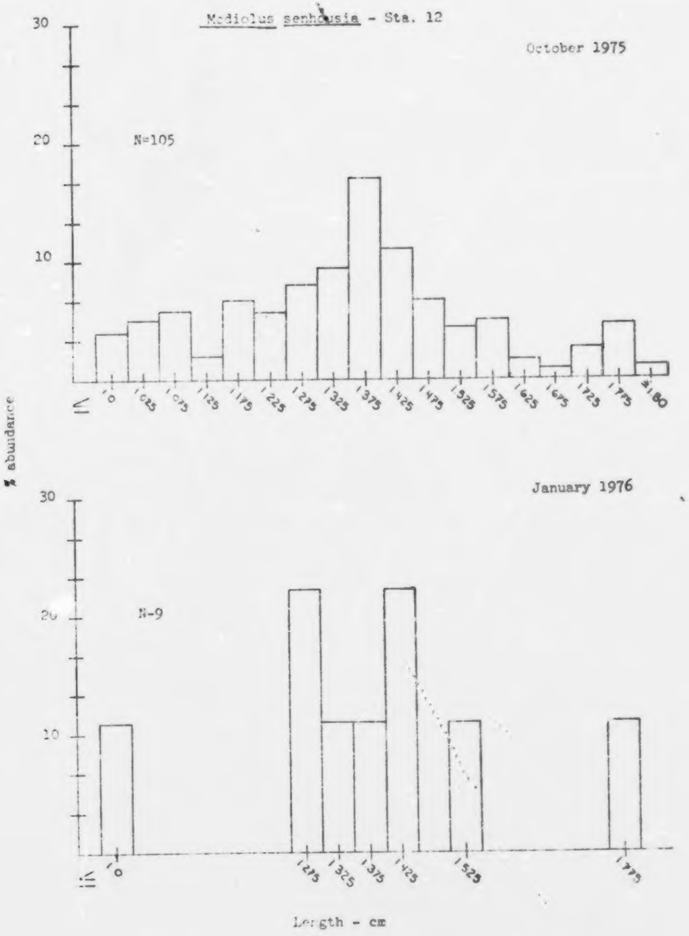
Fig. 6



Modiolus *senhousia* - Sta. 12

Fig. 6 cont.

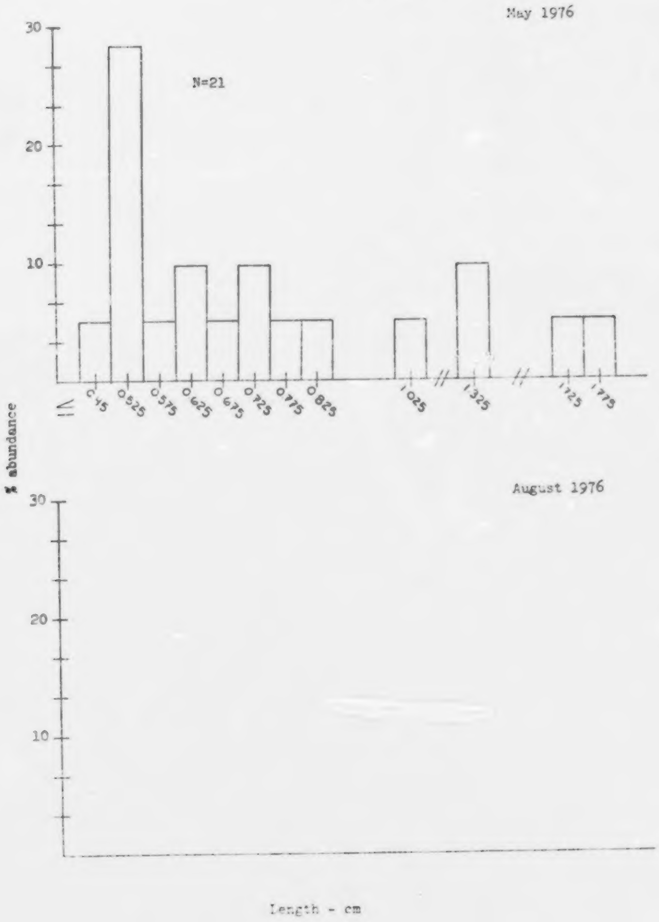


Fig. 7

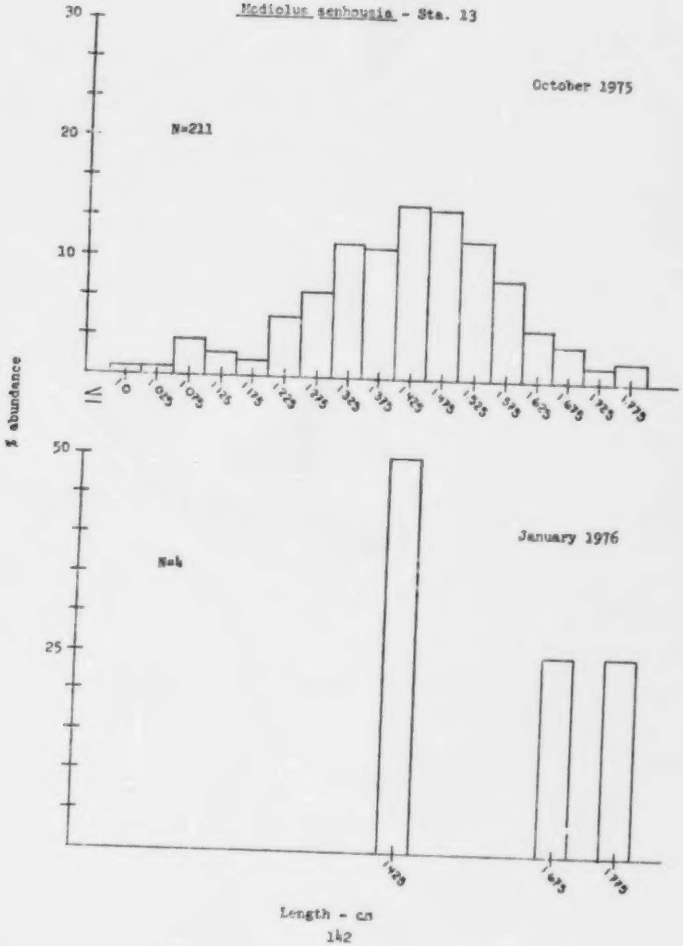


Fig.7 cont.

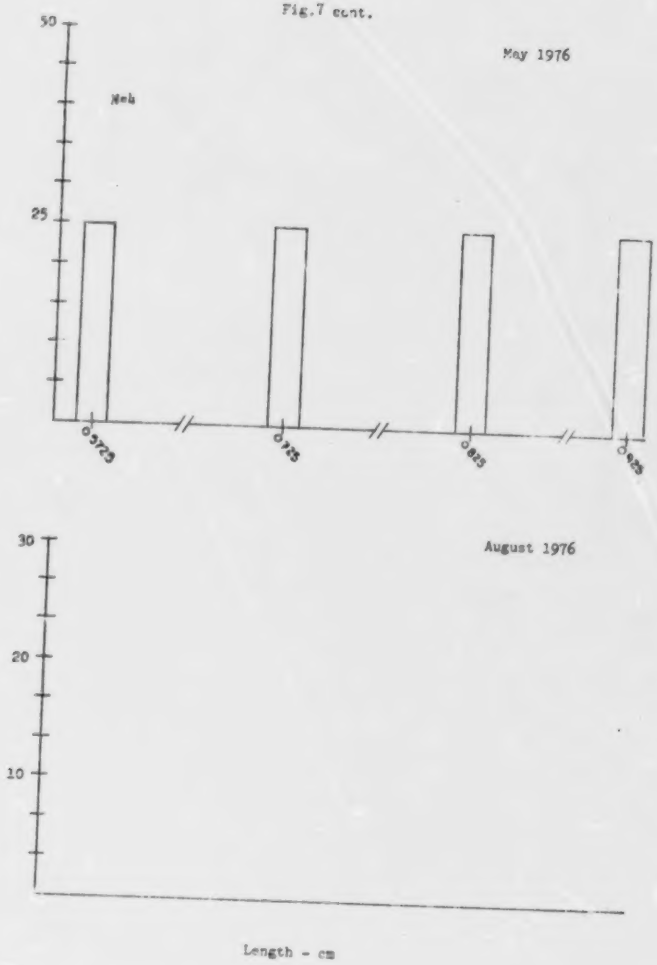
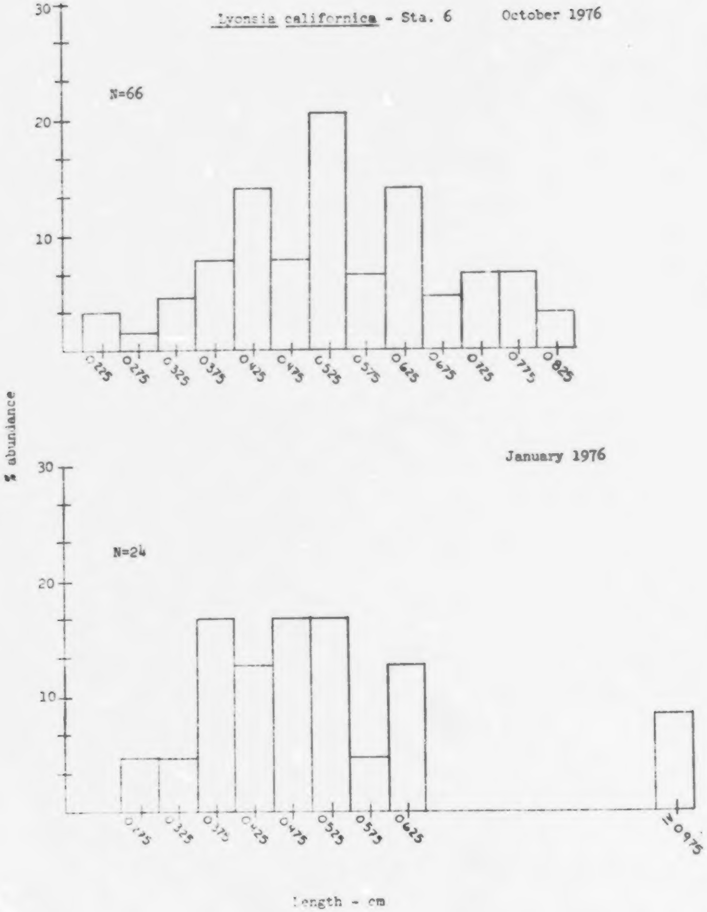
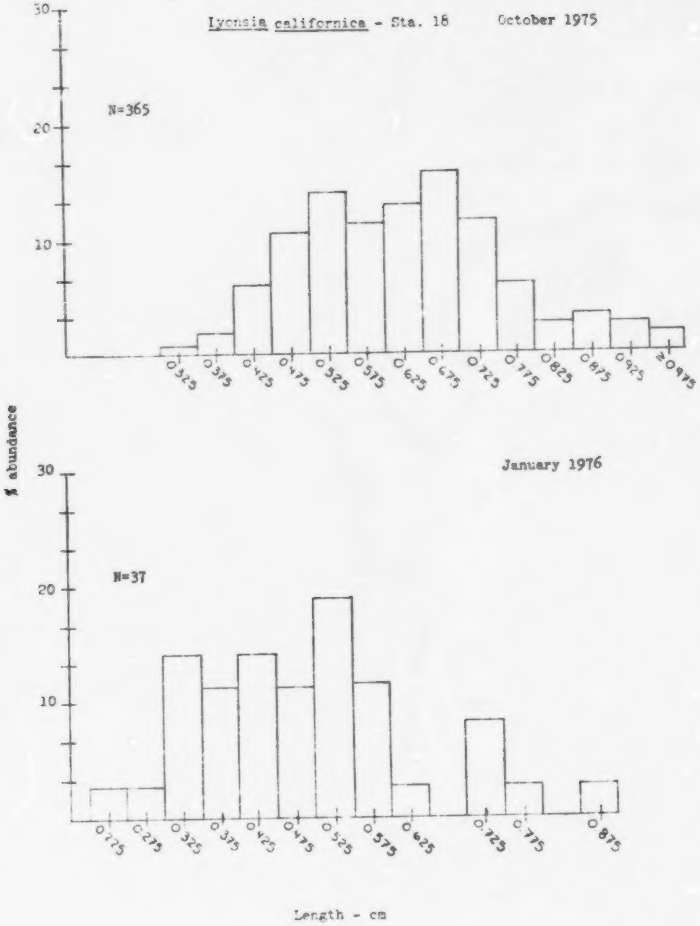


Fig. 8


Lyonsia californica - Sta. 6   October 1976

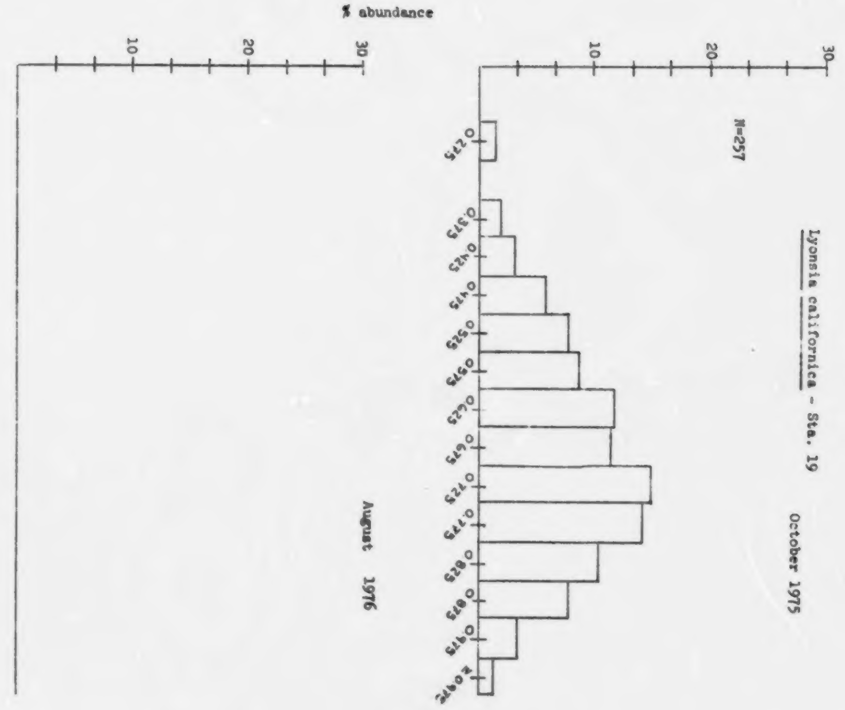
January 1976

Fig. 9


Lyonsia californica - Sta. 18   October 1975

January 1976

Fig. 10


Lyonsia californica - Sta. 19

Treatment- Pres.
Station- 1C
Sub-Sample- I

Appendix VII

TABLE 1

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Macoma nasuta	1	100.00					
Heteromastus filiformis							
Streblospio benedicti	26	38.46	46.15	7.69	7.69		
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	2	100.00					
Macoma balthica	1	100.00					
Tapes japonica							
Ampelisca milleri							
Corophium acherusicum							
Sarsiella spp.							
OLIGOCHAETEA	159	7.55	27.04	43.4	11.95	5.66	2.52
TOTAL	189						

Treatment-Pres.
Station- 1C
Sub-Sample- II

Appendix VII cont.

TABLE 2

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracoda	1			100.00			
Heteromastus filiformis							
Streblospio benedicti	30	43.33	30.00	13.33	6.67	3.33	3.33
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei	2			100.00			
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	3	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	107	22.43	28.97	30.84	9.35	6.64	1.87
TOTAL	144						

Treatment-Pres.
Station-1C
Sub-Sample- III

Appendix VII cont.

TABLE 3

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Macoma nasuta	1	100.00					
Heteromastus filiformis							
Streblospio benedicti	44	38.64	50.00	9.09	2.27		
Eteone lighti	5		60.00	20.00	20.00		
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	3		66,67	33.33			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	87	5.75	32.18	36.78	14.94	5.75	4.60
Ostracods	5			60.00	40.00		
TOTAL	146						

Appendix VII cont.

Treatment- Pres.
Station- 1B
Sub-Sample- I

TABLE 4

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	65	20.00	40.00	33.85	6.15		
Eteone lighti	19		26.32	42.11	21.05	10.53	
Pseudopolydora kempi							
Polydora ligni	1		100.00				
Chaetozone sp.	1			100.00			
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	12	8.33	25.00	66.67			
Corophium ascherusicum	1			100.00			
Sarsiella spp.							
OLIGOCHAETEA	54	1.85	18.52	64.81	11.11	3.7	
TOTAL . . .	153						

Appendix VII con'

Treatment-Pres.
Station- 1B
Sub-Sample-II

TABLE 5

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENTAGE NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	3			33.33	66.67		
Heteromastus filiformis							
Streblospio benedicti	53	15.09	56.60	15.09	1.89	5.66	5.66
Eteone lighti	13		7.69	61.54	15.38	15.38	
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	4	25.00	25.00	50.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	70	2.86	12.86	47.14	21.43	10.00	5.71
TOTAL . . .	143						

Appendix VII cont.

Treatment- Pres.
Station- 1B
Sub-Sample- III

TABLE 6

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENTAGE NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	29	3.45	55.17	37.93	3.45		
Eteone lighti	2				100.00		
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium acherusicum							
Sarsiella spp.							
OLIGOCHAETEA	61		1.64	37.70	31.15	22.95	6.56
TOTAL . . .	94						

Appendix VII cont.

Treatment-Pres.
Station-2B
Sub-Sample- I

TABLE 7

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	9		11.11	89.99			
Heteromastus filiformis	17	94.12	5.88				
Streblospio benedicti	30	6.67	23.33	53.33	16.67		
Eteone lighti	3	33.33	33.33	33.33			
Pseudopolydora kempi	1	100.00					
Polydora ligni	2	100.00					
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	13	30.77	23 08	46.15	30.77		
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium acherusicum							
Sarsiella spp.							
OLIGOCHAETEA	25		12.00	40.00	32.00	16.00	
Cumaceans	2			50.00	50.00		
TOTAL	104						

H-131

H-132

Treatment- Pres.
Station- 2B
Sub-Sample- II

Appendix VII cont.

TABLE 8

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Cumaceans	6		33.33	16.67	50.00		
Heteromastus filiformis	39	48.72		51.28			
Streblospio benedicti	192	1.56	15.63	59.90	20.31	2.08	0.52
Eteone lighti	21	9.52		33.33	38.10	19.05	
Pseudopolydora kempi							
Polydora ligni	1	100.00					
Chaetozone sp.							
Exogone lourei	1		100.00				
Capitella capitata	2		50.00	50.00			
Gemma gemma	16	100.00					
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	21	4.76	19.05	71.43	4.76		
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	25		4.0	20.00	44.00	32.00	
Ostracods	14		21.43	42.86	35.71		
TOTAL	338						

Treatment- Pres.
Station- 2B
Sub-Sample-III

Appendix VII cont.

TABLE 9

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Cumaceans	1			100.00			
Ostracods	16		25.00	50.00	18.75	16.25	
Heteromastus filiformis	7	85.71	14.29				
Streblospio benedicti	177	6.78	10.17	53.11	16.38	12.99	0.565
Eteone lighti	17	17.65	23.53	11.76	23.53	17.65	5.88
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.	1					100.00	
Exogone lourei							
Capitella capitata							
Gemma gemma	8	62.50		25.00	12.50		
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	14	21.43	71.43		7.14		
Corophium ascherusicum	2		100.00				
Sarsiella spp.							
OLIGOCHAETEA	35		28.57	28.57	22.86	11.43	8.57
Glycinde polygnatha	3	100.00					
TOTAL . . .	281						

Treatment-Pres.
Station- 2C
Sub-Sample-I

Appendix VII cont.

TABLE 10

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracoda	42		28.57	40.76	21.43	7.14	
Heteromastus filiformis	17	58.82	41.18				
Streblospio benedicti	335	3.58	5.67	51.94	19.10	18.21	1.49
Eteone lighti	16		25.00	37.50	12.50	25.00	
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	48	50.00	16.67	33.33			
Lyonsia californica	3	33.33	66.67				
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	28	32.14	28.57	39.29			
Corophium acherusicum	2			100.00			
Caprella spp.							
OLIGOCHAETEA	10		60.00	20.00		30.00	
Cumaceans	5			100.00			
TOTAL	506						

Treatment-Pres.
Station-2C
Sub-Sample-II

Appendix VII cont.

TABLE 11

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracoda	18		38.89	38.89	22.22		
Heteromastus filiformis	3	33.33	66.67				
Streblospio benedicti	348	4.60	12.07	53.45	25.29	4.60	
Eteone lighti	11	9.09	18.18	36.36	36.36		
Pseudopolydora kempi							
Polydora ligni	4	50.00	50.00				
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	33	66.67	3.03	30.03			
Lyonsia californica	3	66.67	33.33				
Modiolus senhousia	1	100.00					
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	19	5.26	15.79	78.95			
Corophium acherusicum	1			100.00			
Caprella spp.							
OLIGOCHAETEA	23		17.39	43.48	39.13		
Cumaceans	4			100.00			
TOTAL	468						

Treatment-Pres.
Station- 2C
Sub-Sample-III

Appendix VII cont.

TABLE 12

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis	20	100.00					
Streblospio benedicti	172	8.72	18.02	45.35	19.77	5.81	2.33
Eteone lighti	15	13.33		20.00	53.33	13.33	
Pseudopolydora kempi							
Polydora ligni	1		100.00				
Chaetozone sp.							
Exogene lourei							
Capitella capitata							
Gemma gemma	7	85.71		14.86			
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	5	20.00	60.00	20.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	12			50.00	33.33	16.67	
TOTAL	232						

Treatment-Not Pres.
Station-1B
Sub-Sample- I

Appendix VII cont.

TABLE 13

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	22	4.55	13.64	63.64	9.09	4.55	4.55
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1		100.00				
Corophium ascherusicum	1		100.00				
Sarsiella spp.							
OLIGOCHAETEA	19		5.26	31.58	21.05	21.05	21.05
TOTAL	.43						

Treatment-Not Pres.
Station- 1B
Sub-Sample-II

Appendix VII cont.

TABLE 14

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	7			57.14	42.86		
Heteromastus filiformis							
Streblospio benedicti	23	4.35	26.09	60.87	8.70		
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	4	25.00		75.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	71			14.08	71.83	8.45	5.63
TOTAL	106						

Treatment-Not Pres.
Station-1B
Sub-Sample-III

Appendix VII cont.

TABLE 15

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	8			100.00			
Heteromastus filiformis							
Streblospio benedicti	20		5.00	80.00	10.00	5.00	
Eteone lighti	2		50.00				50.00
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	11		100.00				
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	24			41.67	41.67	8.33	8.33
TOTAL	66						

Treatment-Not Pres.
Station-2A
Sub-Sample- I

Appendix VII cont.

TABLE 16

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	4		25.00	75.00			
Heteromastus filiformis	1			100.00			
Streblospio benedicti	113	1.77		56.64	15.04	22.12	4.42
Eteone lighti	8			37.50	12.50	37.50	
Pseudopolydora kempi							
Polydora ligni	1			100.00			
Chaetozone sp.							
Exogone lourei							
Capitella capitata	2				100.00		
Gemma gemma	19	68.42	5.26	26.32			
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	9		33.33	66.67			
Corophium ascherusicum	5		20.00	80.00			
Sarsiella spp.							
OLIGOCHAETEA	18				22.22	61.11	16.67
Cumacean	3			100.00			
TOTAL	183						

Treatment-Not Pres.
Station-2A
Sub-Sample-II

Appendix VII cont.

TABLE 17

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	1		100.00				
Heteromastus filiformis	5	100.00					
Streblospio benedicti	141	7.09	7.09	56.74	14.89	21.99	4.96
Eteone lighti	4			25.00	75.00		
Pseudopolydora kempi							
Polydora ligni	7	85.71	14.29				
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	18	88.89	11.11				
Lyonsia californica							
Modiolus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	13	7.69	46.15	53.85			
Corophium ascherusicum	1			100.00			
Sarsiella spp.							
OLIGOCHAETEA	13		15.38		30.77	30.76	23.08
TOTAL	203						

Treatment-Not Pres.
Station-2C
Sub-Sample-I

Appendix VII cont.

TABLE 18

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracoda	15			60.00	40.00		
Heteromastus filiformis	10	60.00	10.00				
Streblospio benedicti	41	12.20	2.44	48.88	21.95	7.32	7.32
Eteone lighti	7				57.14	14.29	28.57
Pseudopolydora kempi	1		100.00				
Polydora ligni	1	100.00					
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	7			100.00			
Lyonsia californica	3	66.67	33.33				
Musculus senhousia							
Macoma inquinata							
Macoma balthica	1	100.00					
Tapes japonica							
Ampelisca milleri	23	34.78	26.09	30.43	8.70		
Corophium acherusicum							
Caprella spp.							
OLIGOCHAETEA	4			25.00			75.00
Cumacean	2			100.00			
TOTAL	112						

Treatment-Not Pres.
Station-2C
Sub-Sample-II

Appendix VII cont.

TABLE 19

SPECIES RETENTION

SPECIES	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracoda	5			100.00			
Heteromastus filiformis	20	60.00	40.00				
Streblospio benedicti	41		2.44	19.51	39.02	24.39	14.63
Eteone lighti	10				70.00	10.00	20.00
Pseudopolydora kempi	1		100.00				
Polydora ligni							
Chaetozone sp.							
Exogone lourei	4						100.00
Capitella capitata							
Gemma gemma	21	71.43		28.57			
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	3	66.67	33.33				
Macoma balthica							
Tapes japonica	1	100.00					
Ampelisca milleri	10	40.00	10.00	50.00			
Corophium acherusicum	2		50.00	50.00			
Caprella spp.							
OLIGOCHAETEA	7				57.14		42.86
TOTAL	125						

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 1

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	32	22	28	7	26	18	19	20
Oligochaeta	79	54	76	102	71	52	30	49
Eteone lighti					-	1	-	1
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri							2	2
Sarsiella spp.			2					

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 5

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	7	5	1	5	13	6	5	2
Oligochaeta	20	19	13	29	11	8	26	30
Eteone lighti	-	1	-	2	4	3	-	2
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			1	-	1	1	1	-
Chaetozone sp.								
Microdeutopus schmitti	1							
Corophium ascherusicum								
Ampelisca milleri	21	13	7	8	5	6	45	32
Sarsiella spp.	4	1			-	1	1	-
Gemma gemma	1		--	-				
Cumaceans		3						
Capitella capitata							-	1

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 6

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	25	17	15	18	23	16	11	10
Oligochaeta	32	20	47	44	4	5	3	6
Eteone lighti	3	-	2	1	3	3	1	2
Pseudopolydora kempi								
Polydora ligni					3	1		
Exogone lourei	1	-						
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum		1						
Ampelisca milleri	10	31	15	6	17	20	45	45
Sarsiella spp.	1	2	-	2	2	-	3	5
Capitella capitata			1					
Cumaceans							1	-

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 7

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	1	1	4	-	1	4	4	5
Oligochaeta	6	10	12	9	38	33	34	52
Eteone lighti					3			
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	27	38	19	35	17	18	7	12
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri	48	58	30	34	11	14	14	30
Sarsiella spp.		1	3	1	2	1	2	-
Cumaceans		1		1				

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 8

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	4	2	10	4	4	8	2	1
Oligochaeta	30	26	26	28	41	64	53	45
Eteone lighti	2	1			2	-		
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	17	27	24	24	6	8	13	21
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum		1						
Ampelisca milleri	1	5	28	25	7	10	4	6
Sarsiella spp.	-	2	2			2		
Capitella capitata								1
Cumaceans	-	2	2	1				
Glycinde polygnatha				1				
Eteone californica				1				

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 9

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	10	17	12	13	6	12	9	17
Oligochaeta	14	10		2	-	-	9	7
Eteone lighti				1				
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	12	15	14	20	10	8	21	22
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri	6	10			5	2		
Sarsiella spp.			1					2
Cumaceans			2	1				
Capitella capitata	1							
Spio filicornis	1							

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 10

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	11	14	4	2	9	6	3	1
Oligochaeta								1
Eteone lighti	2	2					2	1
Pseudopolydora kempi								
Polydora ligni	1		1				1	
Exogone lourei	42	65	20	22	36	29	16	23
Chaetozone sp.								
Microdeutopus schmitti	5	2		1				7
Corophium ascherusicum	3							
Ampelisca milleri	54	73	14	6	108	74	32	44
Sarsiella spp.								
Capitella capitata		1					2	
Heteromastus filiformis			1					
Eteone californica	2							
Harmothoe imbricata		1						

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 11

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	2	4	3	2			5	11
Oligochaeta	6	3	2	7	3	4	7	16
Eteone lighti			1	1			1	
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	5	6					6	2
Chaetozone sp.								
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri								
Sarsiella spp.								
Capitella Capitata							1	
Heteromastus filiformis		1						

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Faunal List
0.5 mm Screen Size
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STATION 12

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	6	-	5	3		1	1	
Oligochaeta	8	8	6	3	4	2	5	2
Eteone lighti								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	52	39	12	28	52	42	30	27
Chaetozone sp.							1	
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri	19	22	2	1	12	21	4	3
Sarsiella spp.								

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 13

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	6	2	7	7	11	6	5	3
Oligochaeta	9	7	12	5	21	12	15	8
Eteone lighti			1	1		3	3	2
Pseudopolydora kempi								
Polydora ligni		1	2	4	1		2	
Exogone lourei	20	23	20	22	7	16	6	13
Chaetozone sp.								
Microdeutopus schmitti		1	3	1		1	5	3
Corophium ascherusicum		3						
Ampelisca milleri	46	74	27	38	29	19	18	43
Sarsiella spp.					1			
Cumaceans					1			
Capitella capitata	2		1	1	2	2	2	
Eteone californica	1	3		1	1		1	1
Heteromastus filiformis		1	2		2	3		

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APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 18

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	110	65	117	105	167	136	105	110
Oligochaeta	2	9	8	8	6	8	3	5
Eteone lighti	5	3	6	16	5	3	6	9
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	-	3	-	3	1		2	2
Chaetozone sp.								
Microdeutopus schmitti							2	-
Corophium ascherusicum								
Ampelisca milleri	8	11	13	23	17	12	22	26
Sarsiella spp.	1	4	-	2			6	7
Gemma gemma	5	4		2			3	5
Cumaceans	1	3	-	1				2
Capitella capitata					2			
Eteone californica						1	1	1

APPENDIX VIII

Faunal List
0.5 mm Screen Size
5/1/76

STATION 19

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	30	50	30	13	27	35	27	21
Oligochaeta	4	6	19	18	19	35	11	8
Eteone lighti	1	3	4	3	2	7	1	2
Pseudopolydora kempi								
Polydora ligni	2	3				2		1
Exogone lourei	1	1		4				1
Chaetozone sp.								
Microdeutopus schmitti	1	1	1	1				
Corophium acherusicum								
Ampelisca milleri	2	1						1
Sarsiella spp.								
Cumaceans	4							
Capitella capitata				4	2	4		
Heteromastus filiformis				2	1			

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 20

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	9	5	10	4	8	10	7	11
Oligochaeta	64	70	23	25	62	50	37	48
Eteone lighti							1	1
Pseudopolydora kempi								
Polydora ligni							1	1
Exogone lourei								
Chaetozone sp.							1	2
Microdeutopus schmitti								
Corophium ascherusicum								
Ampelisca milleri								
Sarsiella spp.	5			1				
Capitella capitata	2						4	7
Amaeana occidentalis							1	
Eteone californica								1

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Faunal List
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STATION 25

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	11	13	13	7	10	10	14	15
Oligochaeta	10	10	8	7	21	17		1
Eteone lighti							1	
Pseudopolydora kempi								
Polydora ligni		1				1	6	2
Exogone lourei					1	2		1
Chaetozone sp.								
Microdeutopus schmitti	10	9			1		7	7
Corophium ascherusicum	1	2						3
Ampelisca milleri	4	16					21	54
Sarsiella spp.							2	
Cumaceans							1	1
Heteromastus filiformis				1	1			
Harmothoe imbricata							1	

APPENDIX VIII

Faunal List
0.5 mm Screen Size
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STATION 30

	A		B		C		D	
	1	2	1	2	1	2	1	2
Streblospio benedicti	26	14	14	18	8	14	2	9
Oligochaeta	9	11	3	2	4	4	12	
Eteone lighti	3	1		4		2	10	2
Pseudopolydora kempi								
Polydora ligni	2		2	4				
Exogone lourei					3			
Chaetozone sp.								
Microdeutopus schmitti	6	4	5	6	1		6	7
Corophium ascherusicum	3		2				1	
Ampelisca milleri	50	31	26	28	85	79	47	74
[illegible]ella spp.					2	1		
[illegible]ella carinata	1	3	2	1			2	3
Harmothoe imbricata	1	1						
Heteromastus filiformis							2	

Final Report
on the
South Bay Dischargers
Authority
Wastewater Disposal Project

Benthic Survey and Water Quality
Sampling Program

Submitted to
Environmental Services Section
Bechtel

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SUMMARY

1). A one year baseline study of South San Francisco Bay has been completed. Several aspects of the population biology of selected species of infaunal invertebrates has been described. Measurements of population biology included abundance, size-class, fecundity and recruitment. Faunal and water samples were collected quarterly, the water quality data is not presented in this report.

2). Thirty faunal stations with four replicates per station were sampled in October, 1975. From these stations, fifteen permanent sampling stations were chosen for continued sampling. The selection of the permanent sampling stations were based on the species abundances and their standard errors. Five representative species at eight stations were chosen as a portion of the permanent stations. These species and stations were: *Gemma gemma* - 5, 18, 19; *Musculus senhousia* - 12, 13; *Lyonsia californica* - 6, 18, 19; *Macoma inquinata* - 1, 19; and *Heteromastus filiformis* - 19, 20, 30. The remaining six stations (7,8,9,10,11,25) were chosen because of their location in the bay in respect to the project.

3). All faunal samples were sieved through 1.0 and 0.5 mm screen openings as specified. It was found that individuals of a variety of species passed through the 0.5 mm sieve screen. An experiment was designed to examine the effects of preserving the animals prior to sieving, and the loss of individuals through the 0.5 mm screen size. There were two main results of the experiment. 1). The animals should be preserved before sieving. The magnitude of difference between the mean numbers of animals retained for those preserved before sieving vs. those sieved live was more than doubled. 2). Significant numbers of numerically important (abundant) species passed through the 0.5 mm screen. The percent number of selected animals passing through the 0.5 mm screen ranged from 27% - 47% for those animals preserved before sieving, and from 46% - 91% for the same species sieved live.

4). Sediment analysis revealed that from 65% to 95% of the sediment passed through the smallest screen size of 0.075 mm. Therefore, detailed analysis of sediment changes and faunal-sediment relationships cannot be made. Examination of sediment sieving techniques between wet and dry sieving showed that wet sieving yields a more accurate description of the various sediment size classes.

5). The abundance and size-class data of the selected species provided for a cursory classification of fauna into three groups. Group "A" were those species with similar abundance fluctuations and growth patterns between stations - *Lyonsia californica* and *Musculus senhousia*. Group "B" were those species with different abundance fluctuations, but with similar growth patterns between stations - *Gemma gemma*, and "C" those species with dissimilar abundance changes and growth patterns between stations - *Macoma inquinata*.

6). Analysis of the efficiency of the Ponar grab in this study showed that for estimating the total numbers of individuals or total species, one replicate is sufficient. The number of replicates needed for any particular species was limited by financial considerations to four replicates per stations.

I. INTRODUCTION

A brief review of the approved scope of work for this project is presented in order to clarify the procedures and objectives of this study. The major objective of this study was to describe seasonal changes in the population biology of major species of infaunal and epifaunal invertebrates. The variables to be measured included abundance, size and/or age distribution, fecundity, and recruitment.

A preliminary sampling survey was conducted on September 1, 1975 in South Bay to: 1) familiarize the investigators with the fauna, substrata and other biological variables, and 2) test the different sampling equipment, particularly with respect to faunal sampling characteristics in areas of major interest, and evaluation of sampling techniques with respect to precision of estimation of abundances. The first quarter sampling period in October, 1975 was used to assess the biological nature of the sampling areas and establish permanent sampling stations which best represent the objectives of the study.

The objective described above can be obtained from a suitably designed sampling program. Estimates of the variables have been made using appropriate statistical sampling designs and procedures. The data obtained will provide information that will describe seasonally varying population characteristics. Changes in characteristic population biology will be detectable from comparisons of the aggregate population variables from one sampling period to another. The objective of the study is not to provide inclusive information on all the species present. This is rarely practical. The study will concentrate on species with aggregate sampling and estimation properties (of the variables mentioned) which will permit the most exact estimation of relevant aspects of their ecology.

It should be emphasized that none of the aforementioned estimates can be categorically obtained from some standard size of sample or sampling devices. The estimation of simple standard errors of means of abundances of organisms depends upon their underlying distribution in space, and under different conditions, fewer or more, smaller or larger sample quadrats or grab sizes can have similar estimation properties. The issue is to provide errors of estimates which can then be used to determine if statistically significant changes have occurred. Indeed, different sized sampling devices can be used at different times and still provide the requisite test of significance. If, however, only a small number of specimens are obtained in a sample designed for estimating abundance, but more are needed to estimate fecundity, size distribution or some other variable, then either more samples or larger sample size would have to be taken simply to get enough specimens for observation. The objectives of the preliminary and first quarter sampling periods of the study were to obtain data permitting evaluation of alternate sampling procedures. This evaluation has taken into account the biological and sampling properties or individual species chosen for emphasis in the study.

II. METHODS AND MATERIALS

Thirty faunal stations were established in the South Bay area (Fig. 1) during the first quarter sampling period. Four replicate samples were taken at each station for a total of 120 faunal samples. The location of each faunal station was established by sextant triangulation using large and easily visable, permanent landmarks (Table 1).

The vessel, a 17 ft. Boston Whaler, was anchored for each station, and four replicate samples were taken using a Ponar grab. The volume of the grab was 0.0055 m^3, with a surface area of 0.0504 m^2. This grab was selected because a larger volume, heavier grab would be very difficult to handle safely in shallow water from a small vessel. The grab was manipulated by a crane and a 12 volt battery powered winch attached to the bow of the boat. Each sample was carefully placed into a plastic container and the volume measured with a calibrated ruler.

The samples were fixed in 50% buffered formalin the day of collection, and sieved within one week of collection. Each sample was rinsed through two sieve sizes, 1.0 and 1.5 mm as specified. The fauna from the two sieve fractions were placed in separate containers with 70% isopropanol.

On-board sieving was not used due to its impractability. This type of sieving is done on large vessels that are equiped with running seawater, and where distances between stations are considerable. On-board sieving would require approximately 1

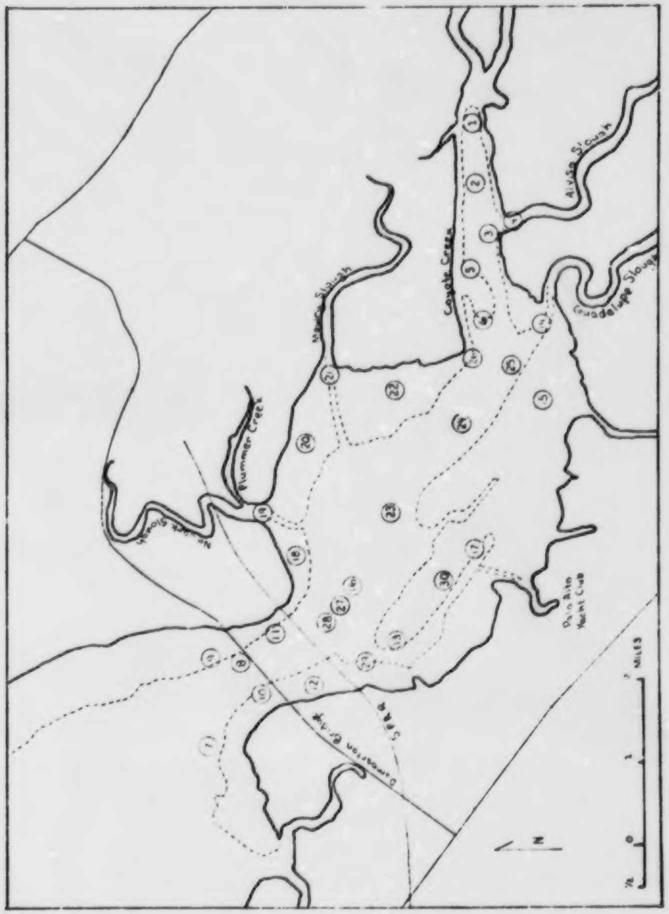
Table I

Benthic Faunal Stations

Sta. #	Location
1	50 yards south of platform in Coyote Creek.
5	In Coyote Creek, in line with the second tower in Coyote Creek and the Zeppelin hangar at Moffet Field.
6	In line with marker R20, second electrical tower in Coyote Creek, and the tall towers in Guadalupe Slough.
7	One hundred yards in channel from marker R14, north of car bridge.
8	North of car bridge in channel; 18° from first and second set of electrical towers on east side and 10° from center of bridge to electrical tower and first tower on west side of bridge.
9	North of car bridge, east side. In line with KGO radio towers and first electrical tower on east side of bridge.
10	In line with electrical towers on east side and second trestle on RxR bridge on east side, 26° to second electrical tower on east side of RxR bridge center and center of car bridge.
11	North of car bridge, in line with R14 marker and center of KGO radio towers.
12	50° between large electrical tower west of car bridge center and electrical tower at east shore where bridge ends, and 12° between center of RxR bridge and Aqueduct building.
13	Mayfield Slough. Next to orange buoy "G".
18	40° to salt flats, 330° to KGO radio towers.
19	60° to salt flats, 300° to KGO radio towers.
20	30° to salt flats and 150° to Moffet Field hangars.
25	Channel marker R19.
30	Between bird cage and orange buoy "G". 135° to Moffet Field, 30° to salt flats, 330° to center of RxR bridge.

Fig. 1

Faunal Stations


Coyote Creek
Alviso Slough
Guadalupe Slough
Mowry Slough
Plummer Creek
Newark Slough
Palo Alto Yacht Club
Dumbarton Bridge
S.P.R.R.
N
0
1
2
Miles
1
2
3
5
20
22
21
20
23
19
18
11
27
28
30
17
13
24
12
10
8
9
7
25

week of field time which would have increased the cost of this project significantly.

A fifth grab sample from each faunal station was taken for sediment analysis. Sediment samples of approximately 100 g were removed for partical size determination.

The sampling dates for the faunal collections were:

Preliminary Survey	9/1/75
First Quarter	10/4,5 - 10/18/75
Second Quarter	1/24/76
Third Quarter	5/1/76
Fourth Quarter	8/20/76

Water quality samples for laboratory analysis were collected and preserved according to the instructions given by the Pacific Environmental Laboratories. The samples were delivered to the Pacific Environmental Laboratories within six hours of collection (Standard Methods, 13th edition, page 34). Fifteen stations with a total of 29 samples per station were made during each quarter survey (Fig. 2, Table II).

Deep water station samples were collected every 3 meters, starting 0.5 m below the surface. Samples were collected in PVC Niskin sampling bottles Model 1010, 1.7 liter capacity. Field measurements included dissolved oxygen (D.O.), temperature, depth, and ph. Dissolved oxygen measurements taken with a YSI Model 54 ARC oxygen meter with a 30.48 m cable length for the probe. The oxygen probe has a built-in pressure compensation vent for deep water analysis. The calibration was done in

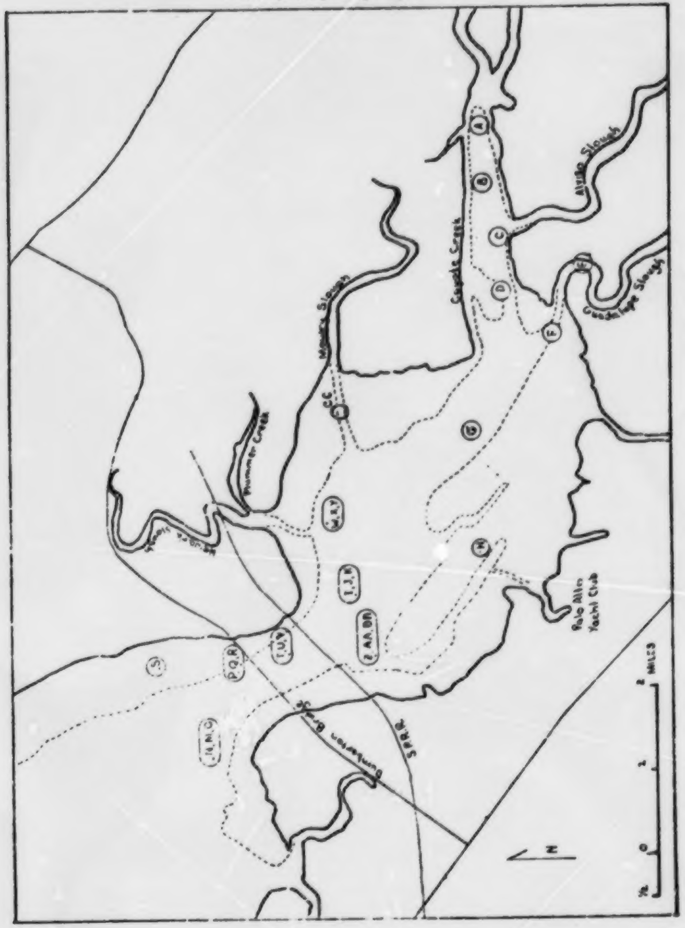
Table II

WATER QUALITY STATIONS

Sta. #	Location
A	Same as faunal station #1.
B	Same as faunal station #2.
C	Same as faunal station #3.
D	West of electrical towers in Coyote Creek, in line with the second electrical tower and the two tallest electrical towers on south side of Coyote Creek, near Guadalupe Slough entrance.
E	In Guadalupe Slough, between the electrical towers just south of N8 channel marker.
F	Same as faunal station #6.
G	Same as faunal station #24.
H.	Bird cage buoy in Mayfield Slough.
I	Same as faunal station #13.
J,K,L	Positioned between the two large electrical poles cenctered north of the car bridge, and with the salt flats.
N,M,O	Marker R14 north of car bridge.
P,Q,R	First electrical tower east of car bridge on north side of bridge.
S	North of car bridge on east side of bay, 30° to KGO radio towers, 190° to center of car bridge.
T,U,V,	Halfway between car bridge and railroad bridge in the center of the channel.
W,X,Y,	150 yards north of R16, south of railroad bridge.
Z,AA,BB	South of railroad bridge, in line with Aqueduct building and salt flats in east side of bay.
CC	Same as faunal station #19

Fig. 2

Water Quality Sampling Stations


A
B
C
D
E
F
G
H
CC
W,X,Y
I,J,K
Z,AA,BB
T,U,V
P,Q,R
S
Alviso Slough
Coyote Creek
Guadalupe Slough
Mowry Slough
Plummer Creek
Newark Slough
Palo Alto Yacht Club
Dumbarton Bridge
S.P.R.R.
N
0
1
2 MILES
½

the field for each measurement using the Air Calibration Technique for sea water (Standard Methods, 13th edition, page 480), and by Winkler Titration, done in the laboratory, before field use. The difference between air and water temperature was less than 5°C. The meter was field calibrated for a chloride concentration of 20,000 mg/l. The D.O. readings were corrected for actual chloride concentrations according to the following formula:

$$DO' = DO + \left[\left(\frac{C' - C}{100}\right) - D_{100}\right]$$

Where DO' equals corrected dissolved oxygen, DO is measured in ppm, C' is the chlorinity used in calibration or 20,000 mg/l, C equals the field or measured chlorinity, and D_{100} is the difference per 100 mg chloride at the temperature used in calibration.

Separate water samples were made for chloride concentration in order to correct D.O. measurements. These samples were analyzed by the Water Quality Laboratory of the Pacific Marine Station. Comparison of the results obtained from the Pacific Environmental Laboratories of chloride concentration with those of the Pacific Marine Station showed no significant difference.

The water temperature was measured with oceanographic reversing thermometers (0.001 adjusted) attached to the Nisken collecting bottles. The ph was measured in the field with a Corning Model 610-A Expand Scale Meter. The water used for the ph measurement was that from the unpreserved water collected for laboratory analysis. Depth was measured with a Heathkit Model Ml-1030 Fathometer.

Samples for coliform bacteria were collected at each station. Every tenth coliform sample was doubled for control purposes. Collection and handling procedures followed Standard Methods, 13th edition, pages 657-660.

The sampling dates for the water quality samples were:

First Quarter	10/17/75
Second Quarter	3/16/76
Third Quarter	7/8/76
Fourth Quarter	11/9/76

III. RESULTS

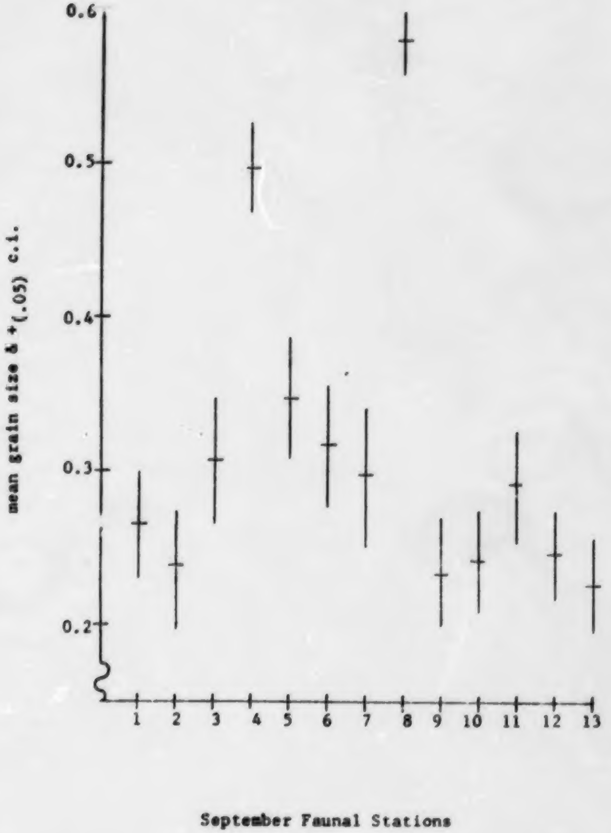
These results deal with the determination of the permanent faunal sampling stations, the selection of the area's representative species, and the analysis of the data to describe the seasonal changes in the population biology of the major invertebrate species in South San Francisco Bay. The first quarter study was conducted in October, 1975 from which 15 permanent sampling stations and 5 representative species were chosen for monitoring purposes during the remaining 3 sampling periods. Independent experiments on particle size and faunal sieving techniques, and size class measurements were also performed to better the sampling program and to increase our knowledge of the local fauna. All raw data is listed in Appendix I - VII.

A. Sediment Analysis

Sediment samples were collected during the September preliminary survey, and during each of the four sampling periods. The sediment samples collected in the September survey were dry sieved through Taylor round sieves, diameter 7.62 cm, with mesh openings of 0.600, 0.425, 0.250, 0.125, 0.180 and 0.075 mm. These mesh sizes correspond to phi units of 0.740, 1.234, 2.000, 2.474, 3.000, and 3.737 respectively. These results, shown in Fig. 3, indicate mean grain sizes of medium to coarse sand. These results seemed contradictory with the particle sizes that were expected to be found. Therefore, a comparative study between dry and wet sieving was conducted to determine which method is most accurate for particle size determination for animal-sediment relationships. Sediment samples collected in Oct-

Fig. 3

Dry Sieved Sediment Analysis



ober, 1975 at similar stations to those collected in September were wet sieved using the same sieve openings. These results, Fig. 4, clearly demonstrate that when the sediment was wet sieved, the particle sizes were generally skewed to the fine sand, silt, and clay fractions. The disparity in results between the two sieving methods are most likely related to the fact that when sediment with large percentages of silt and clay mixed with organic matter are dried and sieved, the fine particles form conglomerates which are then retained on the larger sieve sizes. Wet sieving helps to prevent conglomerates from forming, and thus yields a more realistic size class analysis. The dry sieve analysis indicates considerable variability between stations, whereas obvious exceptions for the wet samples are the stations taken in the channel areas (7,23,24 and 27) where the oyster shell fragments made up a large percentage, thereby increasing the mean grain size.

We realize that sediment data from two different months were compared, however, the difference between the mean grain sizes for wet and dry sieving is significant. Natural sediment errosion and deposition largely affects the find sands, clay and silt fractions. The differences shown here lie in the coarse to medium sand sizes, which are most likely caused by the sieving technique.

Neither wet nor dry sieving is accurate enough to determine the differences in small scale heterogeneity. Microscopic analysis is necessary to accurately relate species distributions

Fig. 4

Wet Sieved Sediment Analysis

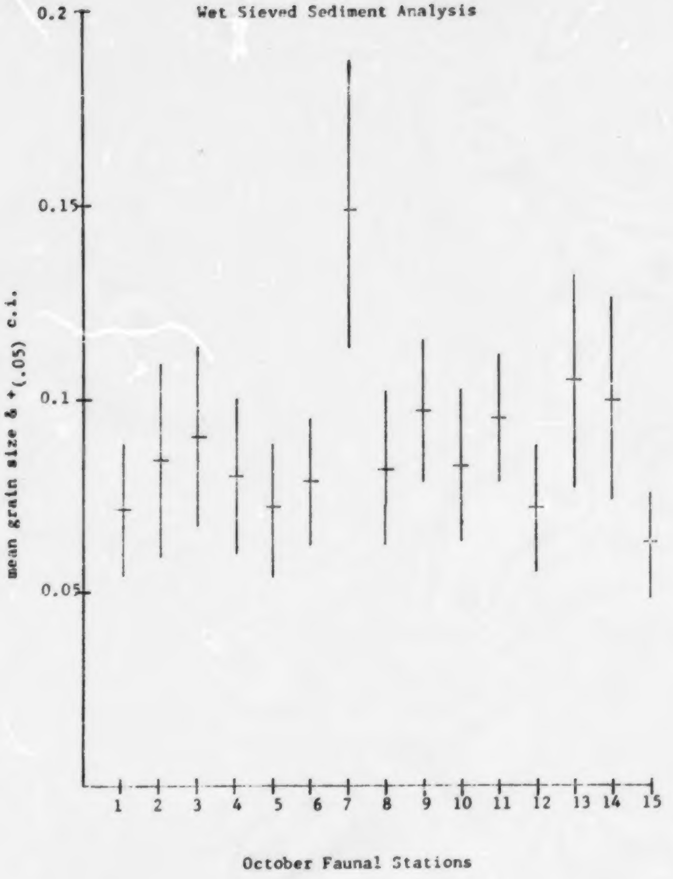
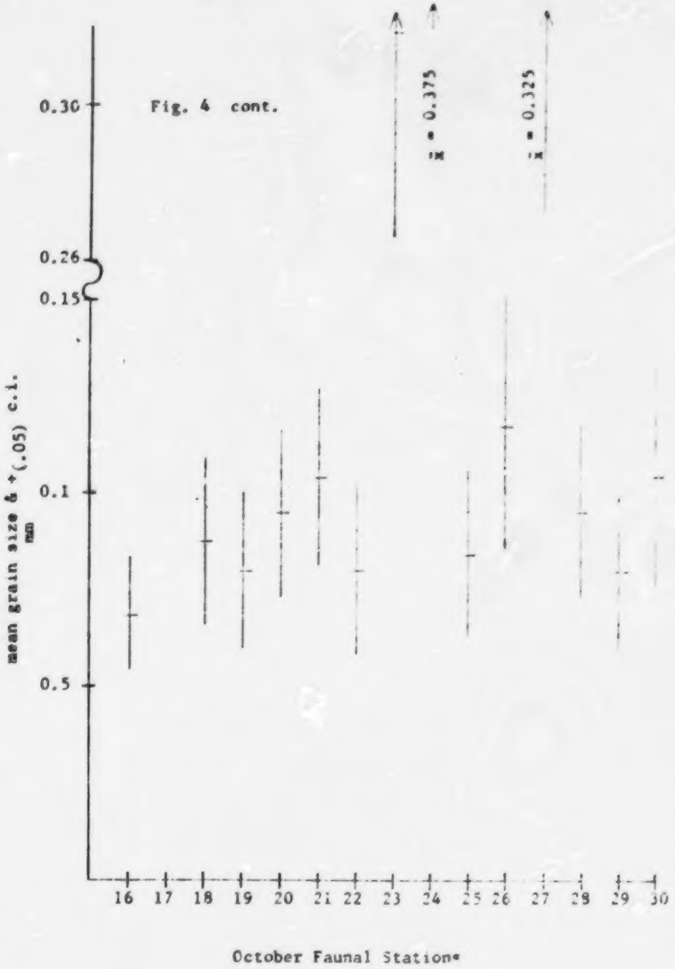


Fig. 4 cont.

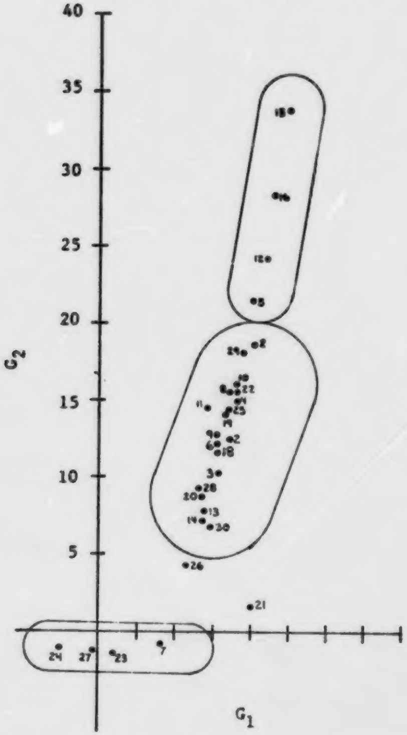


in small areas to sediment differences (Smith, 1975). However, these techniques are expensive and time consuming, well beyond the scope of this project. In view of this fact, wet sieving is the best alternative for a reasonable estimation of partical size distribution.

A technique for determing differing sand environments is a scatter diagram of skewness (G_1) vs. kutosis (G_2) taken from Mason and Folk (1958). Figure 5 is a G_1 vs G_2 scatter diagram for the October, 1975 wet sieved samples. Each station is represented by a dot and station number. These results indicate three sand environments with the channel stations clearly separated in size characteristics. The fact that many of the stations are closely grouped did not allow for a clear-cut selection of permanent sampling stations based upon sediment characteristics alone. The permanent sampling stations were selected in each major division of sediments in order to monitor these different environments.

Fig. 5

Wet Sieved G_1-G_2 Analysis



B. Faunal Analysis

The invertebrate marine fauna collected from South Bay is listed in Table III. A total of 40 species in 6 phyla were found. The polychaetes were the most diverse group with 45% of the total number of species. The molluscs and arthropods were nearly equal in species variety, 22.5% (bivalves - 17.5 and gastropods - 5%) and 20% respectively.

B.1 - The 0.5 mm Sieve Fraction

Many of the 0.5 mm fractions contained large numbers of oligochaetes, primarily the species *Peloscolex gabriellae*, *P. apectinatus*, and *P. nerthoides*. These same fractions also contained the polychaetes *Streblospio benedicti*, *Polydora ligni*, *Psuedopolydora kempi*, *Eteone lighti*, and *Exogone lourei*, some small amphipods, and occasionally the bivalve *Gemma gemma*.

The 0.5 mm fractions were sub-divided prior to counting for two reasons; the high abundance of animals, and the amount of sediment and organic matter in some samples, can be so great that attempts to enumerate the entire sample was not practical. In some cases, initial estimates of *S. benedicti* and oligochaetes exceeded 10,000 per m^2. Therefore, each fraction was sub-divided into eight sub-samples using a modified sediment splitter. Preliminary analysis showed that the splitter divided a full sieve fraction into eight nearly equal sub-samples. The analysis consisted of repeatedly splitting the same set of samples, and counting the animals in all sub-samples. The design of the splitter was such that the full 0.5 mm fraction was randomly divided

Table III

South San Francisco

Species List

- **PHYLUM CNIDARIA**
  - Class Anthozoa
    - Family Diadumenidae
      - *Diadumene* sp.

- **PHYLUM ANNELIDA**
  - Class Oligochaeta
    - Family Tubificidae
      - *Peloscolex apectinatus* - Brinkhurst, 1965
      - *Peloscolex gabriellae* - Marcus, 1950
      - *Peloscolex nerthoides* - Brinkhurst, 1965
  - Class Polychaeta
    - Family Capitellidae
      - *Capitella capitata* - (Fabricius, 1780)
      - *Heteromastus filiformis* - (Claperede, 1864)
    - Family Cirratulidae
      - *Chaetozone* sp.
    - Family Eunicidae
      - *Marphysa sanquinea* - (Montagu, 1815)
    - Family Glyceridae
      - *Glycera polygnatha* - Hartman, 1950
    - Family Maldanidae
      - *Asychis elongata* - (Verrill, 1873)
    - Family Nephtydae
      - *Nephtys caecoides* - Hartman, 1938
    - Family Nereidae
      - *Neanthes succinea* - (Frey & Leuckart, 1847)
    - Family Orbiniidae
      - *Haploscoloplos elongatus* - (Johnson, 1901)
    - Family Phyllodocidae
      - *Eteone californica* - Hartman, 1936
      - *Eteone lighti* - Hartman, 1936
    - Family Polynoidae
      - *Harmothoe imbricata* - (Linnaeus, 1767)
    - Family Spionidae
      - *Polydora ligni* - Webster, 1879
      - *Pseudopolydora kempi* - (Southern, 1921)
      - *Scolelepis squamatus* - (Miller, 1806)
      - *Streblospio benedicti* - Webster, 1879
    - Family Syllidae
      - *Exogone lourei* - Berkeley: Berkeley, 1938
    - Family Terebellidae
      - *Amaeana occidentalis* - (Hartman, 1944)

- **PHYLUM ARTHOROPODA**
  - Class Crustacea

Table III (cont.)

- **PHYLUM ARTHOROPODA (continued)**
    - **Subclass Ostracoda**
    - **Subclass Cirripedia**
      - **Order Thoracica**
      - **Suborder Balanomorpha**
        - *Balanus* **sp.**
    - **Subclass Malacastraca**
      - **Division Leptostraca**
        - **Order Isopoda**
        - **Suborder Valvifera**
          - *Synidotea laticauda* - **Benedict, 1897**
        - **Order Amphipoda**
        - **Suborder Gammaridea**
          - **Family Ampeliscidae**
            - *Ampelisca milleri* - **Barnard, 1954**
          - **Family Corophiidae**
            - *Corophium acherusicum* - **Costa, 1857**
            - *Microdeutopus schmitti*-**Shoemaker,1942**
        - **Order Decapoda**
        - **Suborder Natantia**
          - **Tribe Caridea**
            - *?Crangon* **sp.**
        - **Suborder Reptantia**
          - **Section Brachyura**
          - **Family Majidae**
            - *Pyromaia tuberculata*-**(Lockington,1877)**

- **PHYLUM MOLLUSCA**
  - **Class Bivalvia**
    - **Subclass Anomalodesmata**
      - **Order Pholadamyoida**
        - **Family Lyonsiidae**
          - *Lyonsia californica* - Conrad, 1837
    - **Subclass Heterodonta**
      - **Order Veneroida**
        - **Family Tellinidae**
          - *Macoma balthica* - (Linnaeus, 1758)
          - *Macoma inquinata* - (Deshayes, 1855)
          - *Macoma nasuta* - (Conrad, 1837)
        - **Family Veneridae**
          - *Gemma gemma* - (Totten, 1834)
          - *Tapes japonica* - Deshayes, 1853
    - **Subclass Pteriomorpha**
      - **Order Mytiloida**
        - **Family Mytilidae**
          - *Musculus senhousia* - (Benson, 1842)
      - **Order Pterioida**
        - **Family Ostreidae**
          - *Ostrea lurida* - Carpenter, 1864
  - **Class Gastropoda**

Table III (cont.)

- **PHYLUM MOLLUSCA (continued)**
    - **Subclass Prosobranchia**
      - **Order Mesogastropoda**
        - **Family Calyptraeidae**
          - *Crepidula fornicata* - **Linnaeus, 1758**
      - **Order Neogastropoda**
        - **Family Nassariidae**
          - *Nassarius obsoletus* - **(Say, 1822)**
- **PHYLUM ECTOPROCTA**

- **PHYLUM CHORDATA**
  - **Subphylum Urochordata**
    - **Class Ascidiacea**
      - **Order Enterogona**
      - **Suborder Phlebobranchia**
        - *Ciona intestenalis* - **(Lennaeus, 1767)**

into eight sub-samples in two steps: first dividing the sample in half then dividing each half into two quarters. Since the preliminary tests showed eight nearly equal sub-samples, two sub-samples were chosen from each 0.5 mm fraction for enumeration. The results are listed in Appendix VII.

B.2 - Sieving Experiment

The small size of the animals and the high organic content of the sieve fractions, led us to believe it was possible that much of the populations of the smallest forms were not completely retained on the 0.5 mm sieve. Therefore, preliminary tests were conducted on some of the fractions to determine if the small forms would go through the sieve with additional washing. It was discovered that when additional sieving was gently done and the waste water passed through 0.250 and 0.180 mm sieves, that some of the species did indeed pass through the 0.5 mm screen. Representatives of the three oligochaete species, the polychaetes *Streblospio benedicti* and *Exogone lourei*, nematodes and some ostracods were retained on the 0.250 and 0.190 mm sieves. Also, some small bivalves, *Gemma gemma*, were also seen on the 0.250 mm screen.

With this information, it was felt that attempts to determine abundancies of the smaller animals retained on the 0.5 mm screen could produce misleading conclusions. Species abundance estimates could seriously be underestimated, and size class determinations could be misleading. For example, Muus (1973) pointed out that in many papers on size class determination using bivalves, the authors have not selected the right sieve size for the species being studied. His studies showed that most of the bivalve larvae collected in the Øresund (Denmark) were smaller than 0.5 mm. If a sieve size larger than the spat is used, the first year class is often reported as spat. This problem can cause misleading conclusions, particularly in short duration studies. Muus (1973) has reported the spat size of a number of bivalves in the same genus as those in this study are about 0.4 mm.

It was decided to design an experiment to examine the number of individuals that were lost through the 0.5 mm screen size. The experiment was to be similar to the design used by Reish (1959) and Hessler & Jumars (1974) were replicate samples were taken and sieved through a series of screens with decreasing mesh openings from 1.0 to 0.180 mm. Such an experiment has been designed and nearly completed, but it differs slightly from the proposed design by Hessler & Jumars. The sieving experiment examines three selected problems concerned with sieving samples of benthic invertebrates to obtain accurate species abundance data. The three problems are: 1) the effect of preserving the animals before sieving, 2) the accuracy of species abundance data using a 0.5 mm screen as the smallest screen size during sieving, as done by Reish and Hessler & Jumars, and 3) the accuracy and precision of species density estimates using a core to sub-sample the larger grabs.

TABLE IV

ANIMAL RETENTION ON ALL SCREEN SIZES

Station	Sieving Treatment	
	Preserved	Unpreserved
18	$\bar{x}$ = 321.5 s = 150.15 n = 6	$\bar{x}$ = 142.5 s = 39.87 n = 6
1	$\bar{x}$ = 144.83 s = 30.35 n = 6	$\bar{x}$ = 67.0 s = 32.50 n = 6

METHODS

Faunal samples were collected from each of two areas in South Bay on May 11, 1976. Stations 1 and 18 were chosen because of the numerous small annelids and the wide variety of species witnessed in previous sampling occasions.

Two sampling devices were used, a Ponar grab and an aluminum core for sub-sampling. The Ponar was the same grab that was used during the quarterly sampling dates. The sub-sampler had a volume 308 ml, an internal diameter of 6.5 cm, and length of 9.9 cm.

Six grab samples were collected in each area. Three random sub-samples were obtained from each grab. Three grab samples were randomly selected along with their respective sub-samples, and preserved with 50% formalin before sieving. The remaining samples were subjected to "live" sieving. All samples were sieved through a series of seven, 1 sq. ft. screens with openings of 1.000, 0.787, 0.5000, 0.295, 0.249, 0.180, and 0.119 mm. Sieving was done with filtered sea water for the samples that were "live" sieved, and with tap water for the preserved samples. After sieving, all samples were preserved in 20% formalin. The animals retained on each size fraction were placed into separate containers and enumerated. Rose Bengal was used to facilitate counting.

RESULTS

Two-thirds of the samples have been enumerated (Appendix

IV). There were no animals seen on the 0.119 mm screen fraction. The preliminary analysis completed to date is addressed to the first two of the three selected problems. The first problem examines the effect of preserving the animals before sieving. In two different sampling areas, the samples preserved before sieving had a significantly higher mean number of animals retained on the sieves than did the samples sieved "live" (Table IV). The magnitude of difference between mean number of animals retained was more than doubled in each area. Examination of the screens during sieving showed that the live animals (particularly the annelids) would wrap themselves around the wire screen, preventing them from being rinsed into a container for preservation and counting. Two methods were considered to remove a greater number of live animals from the sieve screens. The first method was to increase the water pressure which was found to break the animals apart before rinsing them off the screens. The second method of removing the animals individually took considerable time and the success of removing annelids in one piece was very low.

The second selected problem questions the accuracy of using the 0.5 mm screen as the smallest sieving screen to characterize some animal populations encountered during the study. Appendix VII shows the percent of animals that were retained on each of the seven screens. The polychaetes *Streblospio benedicti*, *Eteone lighti* and three species of oligochaetes, *Peloscolex apectinatus*, *P. nerthoides*, and *P. gabriellae* were the dominant fauna that passed through the 0.5 mm screen in significant numbers (Table V). Because of the time involved in separating the oligochaete species by microscopic observations of reproductive organs, the three species are listed together as oligochaetes in the sieve test experiments. For the unpreserved samples, *S. benedicti* had a maximum mean of 46.62% of the individuals which passed through the 0.5 mm screen. Oligochaetes attained a mean loss rate of 91.92% and *E. lighti* reach a 54.17% loss rate. The samples preserved before sieving have a significantly lower loss rate through the 0.5 mm screen. *S. benedicti* had a 27.64% rate, oligochaetes had a 47.66%, and *E. lighti* had a 45.48% loss rate. It is clearly evident that high percentages of fauna can be lost by using an improper screen size for sieving certain animals. Even though the samples preserved before sieving had a lower loss rate, the measured loss will seriously affect the accuracy of species abundance data by using a 0.5 mm screen as the smallest opening to characterize some species populations in the study area.

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Although the data has not been completely analyzed, several important conclusions can be drawn. The animal loss through the 0.5 mm screen necessitates a closer examination of the accuracy of similarly obtained abundance data. It is quite apparent that abundance data should be viewed at the species level in relation to sieving characteristics. Abundance data for those species which significantly pass through the 0.5 mm screen, or any other final sieving screen, should be carefully considered before being combined with the 1.0 mm screen data for quantitative analysis. In this case, the annelids were the dominant infauna to pass through the 0.5 mm screen. Therefore, in those areas where the annelids constitute a major portion of the fauna, a sieving screen size considerably smaller than 0.5 mm is required to retain the annelid population. Another important conclusion is the effect of not preserving the faunal sample before sieving. The difference between the mean number of animals retained on all screen sizes and screen sizes from 0.5 mm and larger are quite significant. Abundance estimates made from "live" sieved data is very likely to be a gross underestimate.

The percent loss rate discussed presents a considerable error factor when analyzing the data. It must be decided whether the established error factor is acceptable. For example, *S. benedicti* had a maximum loss rate, or error factor of 46.62%. The question becomes, is 46.62% a significant percentage of the population not to be counted? Tables VI and VII have been compiled to simply demonstrate the effect an error term might have on species abundance data. The numbers presented are not intended to be definite predictions. The data used to calculate the tables were from stations 1 and 18 of the May sampling date. The appropriate error term was used from Table V to adjust the raw data to its corrected form. The error term used for the preserved data were used. Table V shows the effect of an error term when standardizing the raw data to numbers/m^2. Although all of the data increased proportionately, this table shows a difference it mean values at the number/m^2 level of over 5000 individuals. Table VI demonstrates the difference in magnitude between using the raw data (#/0.05m^2) and transformed data (#/m^2).

Table V

Percent Number of Animals Passing Through

The 0.5 mm Screen Size

Species	Station	Sieving Treatment Preserved	 Unpreserved
Streblospio benedicti	18	$\bar{x}$=27.69 s= 7.45 n= 6 $s^2/\bar{x}$= 2.00	$\bar{x}$=46.62 s=15.52 n= 6 $s^2/\bar{x}$= 5.17
	1	$\bar{x}$= 7.68 s= 4.73 n= 6 $s^2/\bar{x}$= 2.91	$\bar{x}$=16.74 s=11.26 n= 6 $s^2/\bar{x}$= 7.57
Oligochaetes	18	$\bar{x}$=47.66 s=15.60 n= 6 $s^2/\bar{x}$= 5.11	$\bar{x}$=91.92 s=11.57 n= 5 $s^2/\bar{x}$= 1.45
	1	$\bar{x}$=29.32 s=17.24 n= 6 $s^2/\bar{x}$=10.14	$\bar{x}$=60.18 s=14.29 n= 6 $s^2/\bar{x}$= 3.93
Eteone lighti	18	$\bar{x}$=45.48 s=12.07 n= 6 $s^2/\bar{x}$= 3.20	$\bar{x}$=54.17 s=45.87 n= 6 $s^2/\bar{x}$=38.84
	1	$\bar{x}$=40.47 s=36.59 n= 5 $s^2/\bar{x}$=33.08	x=50 n= 1

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TABLE VI

Effects of Sieving Error on Abundance Estimates

Station 18 5/1/76

Strellospio benedicti
0.5 mm Sieve Fraction

Comments	Difference between means	Without Sieving Error	With Sieving Error*
Raw data-3 out of 8 subsamples counted for each replicate	34.82	$\bar{x}$ = 113.91 s = 31.26 C.I. = 133.8-94.0	$\bar{x}$ = 148.08 s = 40.64 C.I.= 173.9-122.3
Average for 4 Ponas Grabs. Multiplication factor on raw data = 8.	273.36	$\bar{x}$ = 911.28 s = 250.0 C.I. = 1,070.0-752.32	$\bar{x}$ = 1184.64 s = 325.1 C.I. = 1,391.2-970.0
Average Per square meter multiplication factor on raw data = 160.	5,467.2	$\bar{x}$ = 18,225.60 s = 5001.6 C.I. = 21,406.0	$\bar{x}$ = 23,692.80 s = 6,502.4 C.I. = 27,824.0-19,560.0

*Sieving Error = 30%, obtained from samples preserved before insieve test for station 18, for S. benedicti (Table IV).

TABLE VII
ESTIMATED FAUNAL DENSITIES

Station	Species	Including Sieving Error 1.0 & 0.5 mm screen size	Raw Data 1.0 & 0.5 mm screen size
1	*Streblospio benedicti*	8,091/m^2	394/grab
	Oligochaetes	13,260/m^2	513/grab
	Macoma inquinata	290/m^2	16/grab
18	*Streblospio benedicti*	25,597/m^2	101/grab
	Oligochaetes	1,666/m^2	57/grab
	Eteone lighti	2,449/m^2	110/grab
	Heteromastus filiformis	1,035/m^2	52/grab
	Gemma gemma	935/m^2	47/grab
	Macoma inquinata	40/m^2	2/grab

Very small standard errors in the raw data will account for very large standard errors in the transformed data. When comparing data with large standard error terms, only large abundance changes will statistically be seen.

When modifying raw data to a standardized dimension, such as a square meter, a basic assumption must be made about the spacial distribution of the fauna. That assumption is that the distribution in the grab accurately represents the distribution of the entire square meter. Our experience has shown that most infaunal distribution patterns are aggregated. Therefore, the spacial distribution in any particular square meter is not homogenous, and the distribution pattern enclosed in a Ponar grab is not necessarily the same as in a square meter. An indicator of aggregated distributions is the variance to mean ratio (s^2/x) When this ratio exceeds 1.0, then aggregated distributions are indicated. With values consistently greater than 2.0, Table V indicates aggregated distribution patterns. The effect that aggregated distribution patterns have on density estimates, especially when magnifying data to a standard dimension, is unknown. The estimated value could be considerably higher or lower than what the actual value should be. There are two way to minimize the effects of magnifying the data to a standardized dimension: choose a smaller standard dimension, and take more samples so that the variance is minimized.

The remainder of the sample will have to be enumerated before any conclusions can be drawn as to the accuracy and precision of species density estimates using a core to sub-sample the larger grabs. The planned analysis involves a nested ANOVA (analysis of variance) as a prelude to finding the number of replications needed to detect a given "True" difference between means, and also possibly examining optimum allocation of resources which is similar to a cost analysis. These analysis, however, may not necessarily determine the number of replicates that should be taken, because statistically there is no optimum number of samples that can be taken. In general, the more samples taken, the smaller the standard error of the mean. This particularly holds true when the initial number of samples is small and the number of samples is increased. In examining seasonal changes in species abundance, the issue for collecting abundance data is to provide errors of estimates which can then be used to determine if statistically significant changes have occurred. The number of replicate samples to be taken depends on other considerations. One is the minimal level of precision that is to be accepted. Another is the amount of time required to process the samples in relation to the frequency of sampling dates. Additional samples using the coring device may have to be made for a better determination of the number of replicates needed.

If the abundance of a species, or a group of species is important in characterizing the station or area being sampled, then the sieve size selection is very important when the organisms are small. Table VI illustrates this point as the most abundant forms at stations 1 and 18 are the small annelids. In order to characterize these stations, based upon abundance data, a smaller sieve size would be necessary. In order to increase accuracy and reduce cost of analysis, small sub-samples should be made.

The important point of the sieve test is that the sampling procedure must reflect the organism being sampled and the questions asked of the data. Two or more sampling techniques should be used in future monitoring of the South Bay area to accurately sample the various animal populations.

B.3 - Determination of Permanent Sampling Stations and Selecting Representative Species

The benthic sampling program for South Bay was designed to obtain information on the major invertebrates in the area. Permanent sampling stations were chosen to monitor the fauna which best represents the South Bay area. Therefore, the selection of the permanent sampling stations and the representative species is closely related. The financial limits of this project allowed for 30 stations to be initially sampled in October, 1975 from which 15 stations would be chosen for continued sampling. The data used for the selection of the permanent sampling stations and the representative species was obtained from the 1.0 mm screen size. Table VIII summarized the pooled species data for all stations and all replicate samples for October, 1975. The criteria for selecting the species which best represent the South Bay area were those species which had a high frequency of occurrence, a high mean density, and a low coefficient of variation (CV). Coefficients of variation are used to compare the

Table VIII

Faunal Abundances Taken With a 0.05 m^2 Ponar Grab

October, 1975, 1.0 mm Sieve Fraction

SPECIES	TOTAL NUMBER	MEAN (CV^1)	$t_{(.05)}$95% upper	c.i.^{2} lower	MEAN NO. PER m^2	# SAMPLES PRESENT	FREQ.
Gemma gemma	2738	23.809(17.2)	31.979	15.638	432.89	71	.617
Amphipoda*-pooled	2135	18.565 (21.4)	26.435	10.695	337.55	54	.470
Lyonsia californica	2126	18.487(23.1)	26.938	10.036	336.13	62	.539
Musculus senhousia	1614	14.035(14.4)	18.024	10.045	263.40	68	.591
Macoma inquinata	1017	8.843(16.8)	11.778	5.909	160.78	67	.583
Heteromastus filiformis	986	8.574(13.6)	10.887	6.261	155.89	81	.704
Streblospio benedicti	397	3.452(31.9)	5.632	1.272	62.76	37	.322
Asychis elongata	216	1.878(17.7)	2.536	1.220	34.15	41	.357
Marphysa sanguinea	146	1.270(18.2)	1.726	0.813	23.09	38	.330
Macoma balthica	139	1.209(17.1)	1.618	0.799	21.98	39	.339
Glycinde polygnatha	134	1.165(47.5)	2.261	0.069	21.18	31	.270
Eteone lighti	91	0.791(18.4)	1.080	0.502	14.38	34	.296
Amaeana occidentalis	85	0.739(66.8)	1.233	0.246	13.44	15	.130

1=cv-coefficient of variation

2=confidence intervals

Table VIII

SPECIES	TOTAL NUMBER	MEAN (CV^1)	$t_{(.05)}$ 95% upper	c.i.^{2} lower	MEAN NO. PER m^2	#SAMPLES PRESENT	FREQ.
Neanthes succinea	78	0.678(22.4)	0.979	0.377	12.33	26	.226
Pseudolpolydora kempi	69	0.600(59.2)	1.303	0.000	10.91	14	.122
Polydora ligni	30	0.261(46.7)	0.502	0.019	4.75	10	.087
Tapes japonica	27	0.235(24.3)	0.348	0.121	4.27	18	.157
Chaetozone sp.	15	0.130(33.5)	0.217	0.044	2.36	10	.087
Nephtys caecoides	13	0.113(39.0)	0.200	0.026	2.05	9	.078
Harmothoe imbricata	7	0.061(46.7)	0.117	0.005	1.11	5	.043
Exogone lourei	3	0.026(57.2)	0.056	0.000	0.47	3	.026
Macoma nasuta	2	0.017(71.0)	0.042	0.000	0.31	2	.017
Ciona intestinalis	121					15	
Crepidula fornicata	11					4	
Caridea fragment	1					1	
Balanus sp.	1					1	
Stylatula elongata	7					4	
Capitella capitata	1					1	

1=cv-coefficient of variation

2=confidence intervals

Table VIII

SPECIES	TOTAL NUMBER	MEAN (CV^1)	$t_{(.05)}$ 95% upper	c.i.^{2} lower	MEAN NO. PER m^2	# SAMPLES PRESENT	FREQ.
Spio filicornis	1					1	.009
Pyromaia tuberculata	1					1	.009
Nassarius obsoletus	1					1	.009
Bryozoa	1					1	.009
Ostrea lurida	1					1	.009
Leptocottus armatus	2					1	.009
Ampelisca milleri	1458	12.678(16.3)			230.49	56	.487
Microdeutopus schmitti	96	0.835(30.1)			15.18	16	.139
Corophium acherusicum	4	0.035(49.0)			0.632	4	.035

1=cv-coefficient of variation

2=confidence intervals

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variances of two or more populations independent of the magnitude of their means. The CV is the standard deviation expressed as a percentage of the mean. The selected criteria will indicate which species populations have wide-spread occurrence, comparatively high densities, and a minimal error factor to allow easier determination of population abundance fluctuations. Based upon the data in Table IX, the representative species are: the bivalves - *Gemma gemma, Lyonsia californica, Musculus senhousia, Macoma inquinata*, and the polychaete - *Heteromastus filiformis*.

Some of the permanent sampling stations were chosen according to the distribution of the representative species within each of the thirty preliminary stations (Table X). Only those stations where each of the representative species occurred in three or more replicates are listed. The requirements for determining these permanent sampling stations based on the established representative species information were: 1) enough individual present so that changes in the population densities would not eliminate the population, and 2) a low coefficient of variation that will enable population fluctuations to be more easily noticed.

Without "a priori" knowledge of the range of population fluctuations for the representative species, the minimal densities required to maintian a yearly measureable population is not known. Therefore, representative species have been chosen which have the largest number of individuals and a low CV.

Table IX

Sta.#	G. gemma		L. californica		M. senhousia		M. inquinata	
	$\bar{x}^1$	CV[2]	$\bar{x}$	CV	$\bar{x}$	CV	$\bar{x}$	CV
1							68.00	19.75
2							19.00	11.16
3								
4	31.00	31.69	7.25	42.65			33.00	25.43
5	66.75	16.05			11.25	40.79		
6	24.67	43.93	35.33	9.29	25.00	20.78	5.00	23.09
7								
8								
9	11.75	19.46	1.25	38.30	46.25	23.59	0.25	100.00
10					15.00	26.11		
11	3.00	78.17	7.00	29.16	2.25	42.07	2.75	27.27
12	12.25	10.20			26.50	13.30	1.25	50.33
13					56.00	20.66		
14					10.25	35.03	10.25	35.03
15					17.00	26.20	17.00	26.20
16					17.25	15.41		
17	72.50	72.73						
18	129.25	20.96	106.75	30.85	2.75	58.18	7.75	29.51
19	107.25	18.16	78.50	8.89			22.50	6.41
20	9.75	8.76	2.75	31.05			12.25	22.45
21	108.00	35.52	17.00	14.21			8.75	23.50
22	13.75	7.42					6.50	22.21
23								
24								
25	30.00	57.20	24.00	43.13	47.00	37.16	1.00	70.71
26	10.75	20.93	7.50	31.03	30.50	25.20	14.00	11.05
27								
28					6.75	27.96		
29					50.00	32.68		
30	26.33	11.25	9.75	47.26	7.25	41.90		

1 = mean
2 = coefficient of variation

Table IX cont.

Sta.#	*H. filiformis*		*A. elongata*		*M. sanguinea*		*M. balthica*	
	$\bar{x}$[1]	CV[2]	$\bar{x}$	CV	$\bar{x}$	CV	$\bar{x}$	CV
1							7.25	48.66
2							2.75	31.11
3								
4	0.67	100.00					4.25	43.34
5								
6	4.33	65.77					1.67	85.88
7					2.50	50.33		
8			5.00	52.92				
9	3.00	19.25	6.00	13.61				
10	4.25	58.72						
11	3.25	60.73					0.50	57.73
12								
13	4.00	36.80	5.75	44.55	1.50	43.03		
14	1.25	39.89						
15	3.00	40.82						
16			5.50	59.61				
17								
18	24.50	28.11	8.75	35.94			1.00	70.71
19	38.50	16.92	1.25	38.30				
20	39.25	13.57	4.00	27.00			2.75	27.27
21	18.25	27.34						
22	12.25	27.76					2.75	34.38
23	2.25	37.95			8.75	17.69		
24	1.50	33.33			2.75	9.09		
25	9.75	52.02						
26	13.00	42.83					1.25	20.00
27	2.50	25.82						
28	12.75	37.67	1.00	40.82	4.25	17.65		
29	5.50	33.61	9.25	35.41				
30	27.50	19.94	4.00	33.85	2.75	28.93		

1 = mean
2 = coefficient of variation

Table X

Sta. #	N	$\bar{x}$	s	$s_{\bar{y}}$	CV
Macoma inquinata					
1	2	62.00	9.89	6.99	11.28
	3	76.33	25.79	14.89	19.51
	4	68.00	26.85	13.42	19.74
19	2	22.50	4.94	3.49	15.55
	3	22.60	3.51	2.02	8.97
	4	22.50	2.88	1.44	6.41
Gemma gemma					
5	2	70.00	26.87	18.99	27.14
	3	73.66	20.03	11.56	15.70
	4	66.75	21.42	10.71	16.04
18	2	159.50	71.41	50.50	31.66
	3	137.67	63.08	36.42	26.45
	4	129.25	54.19	27.09	20.96
19	2	130.50	41.71	29.50	22.60
	3	109.00	47.50	27.42	25.16
	4	107.25	38.94	19.47	18.15
Musculus senhousia					
12	2	32.50	2.12	1.49	4.61
	3	28.33	7.37	4.25	15.02
	4	26.50	7.04	3.52	13.35
13	2	37.00	9.00	6.36	17.19
	3	49.66	23.71	13.69	27.56
	4	56.00	23.13	11.56	20.65

$\bar{x}$ = mean
s = standard deviation
$s_{\bar{y}}$ = standard error
CV = coefficient of variation

Table x cont.

Sta. #	N	$\bar{x}$	s	$s_{\bar{y}}$	CV
Lyonsia californica					
18	2	153.50	6.36	4.49	2.93
	3	107.00	80.66	46.57	43.52
	4	106.75	65.86	32.93	30.85
19	2	87.50	14.84	10.49	11.99
	3	80.00	16.70	9.64	12.05
	4	78.50	13.96	6.98	8.89
Heteromastus filiformis					
19	2	36.00	15.55	10.99	21.60
	3	41.33	14.36	8.29	20.06
	4	38.50	13.02	6.51	16.91
20	2	33.00	8.48	6.00	18.18
	3	39.66	13.01	7.51	18.94
	4	39.25	10.65	5.32	13.57
30	2	35.00	11.31	7.99	22.85
	3	29.33	12.66	7.31	24.92
	4	27.50	10.96	5.48	19.44

$\bar{x}$ = mean
s = standard deviation
$s_{\bar{y}}$ = standard error
CV = coefficient of variation

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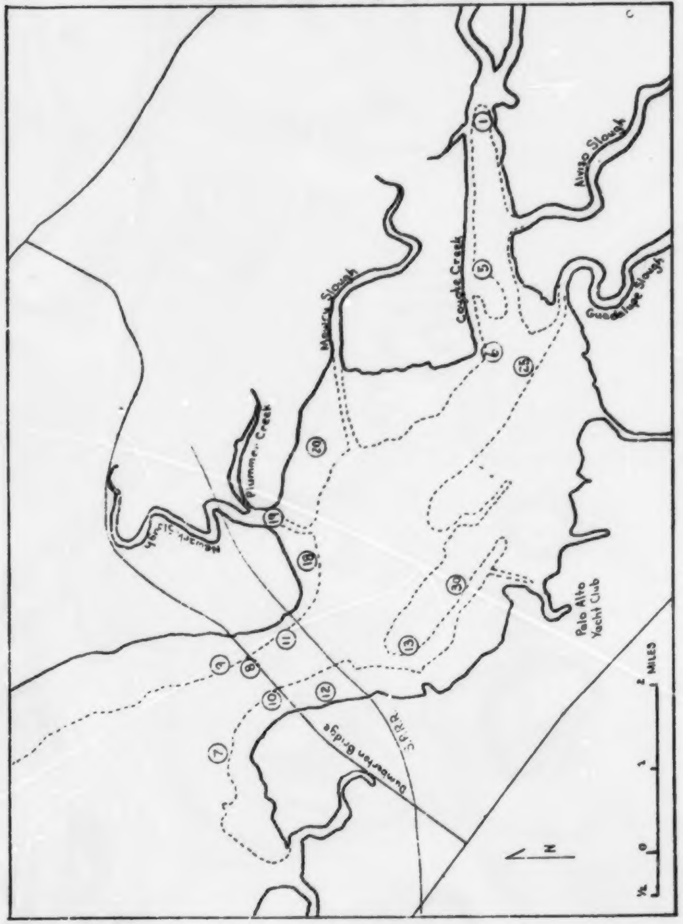
It is evident from Table IX that any given fifteen stations will not satisfactorily include all eight representative species. Therefore, stations were selected which best reflect large numbers of the representative species, whether one station for a particular species or for several species. The following is a list of the stations and their respective species which were emphasized during the study: *Gemma gemma*, stations 5, 18, and 19; *Lyonsia californica*, stations 6, 18, 19; *Mucculus senhousia*, stations 12 and 13; *Macoma inquinata*, stations 1 and 19; and *Heteromastus filiformis*, stations 19, 20, and 30.

The selected eight stations will provide the abundance and size class data for the representative species. Seven more stations were selected because of their location to the project, i.e. near the diffuser discharge point or because they were representative of the major sediment classes. These remaining stations were 7, 8, 9, 10, 11 and 25 to bring the total number of permanent sampling stations up to 15 (Fig. 6).

Fig. 6

Permanent Benthic Sampling Stations


Alviso Slough
Coyote Creek
Guadalupe Slough
Mowry Slough
Plummer Creek
Newark Slough
Palo Alto Yacht Club
Dumbarton Bridge
SPRR
1
5
6
25
20
14
18
30
11
13
9
8
10
12
7
N
½
0
1
2
MILES

C. __Faunal Abundance Data__

The faunal abundance data from the 1.0 mm and 0.5 mm screen sizes for all four sampling periods are shown in Appendixes VI and VII. The discussion of the faunal data will be limited to those animals retained on the 1.0 mm screen fraction. This restriction is not to imply that those organisms retained on a 0.5 mm screen are not important. On the contrary, in some of South Bay, *Streblospio benedicti* and the oligochaetes clearly dominated the local fauna. However, the sieve experiment pointed out that significant individuals of certain species, particularly the annelids, passed through the 0.5 mm screen. We therefore, have no real knowledge of the population abundance changes for *S. benedicti* and other such organsims because of the loss of individuals. The absence of this data makes it difficult to include these species in detailed discussions.

Common to all faunal stations in South Bay were the ubiquitous species: the polychaetes *Heteromastus filiformis* and *Streblospio benedicti*; the bivalves *Gemma gemma*, *Lyonsia californica*, and *Musculus senhousia*; and the amphipod *Ampelisca milleri*. Of these, only *A. milleri* was abundant inside Coyote Creek (station 1). These species were not always the most abundant species at each station.

Excluding the ubiquitous species, the fauna of South Bay can be qualitatively divided into three primary species - location or species - station groupings. These groupings are based on observation of the final data, and have been designed for descriptive purposes. The species listed are the dominant organisms with respect to each species - station grouping.

The first such grouping is the Coyote Creek area (stations 1,5,6, and 25). There were four dominant species that inhabited this area. These species were the polychaetes *Eteone lighti* and *Neanthes succinea*, and the bivalves *Macoma inquinata* and *Macoma balthica*. In fact, *N. succinea* was almost absent in other areas of South Bay, and *M. inquinata* had its highest abundance at station 1.

The central portion of South Bay (stations 13,8,19,20, and 30) had a wide variety of dominant species. The polychaetes *E. lighti*, *Asychis elongata* and *Glycinde polygnatha* were distributed throughout this region. *Nephtys caecoides* was occasionally present and *Chaetozone* sp. and *Pseudopolydora kempi* were most common on the northern shore at stations 18,19, and 20. The bivalves *M. inquinata* and *M. balthica* were present; *M. inquinata* occurred predominantly at station 19. *Macoma nasuta* was also present in small numbers.

Outer South Bay (stations 7,8,9,10,11, and 12) was dominated by three species of polychaetes and bivalves. *Nephtys caecoides*, *A. elongata*, and *G. polygnatha* were the polychaetes. The bivalves were *M. nasuta*, *Tapes japonica*, and in low numbers were, *M. inquinata*. *Nephtys caecoides* and *M. nasuta*, which occurred occasionally in central South Bay, were present in relative abundance in this area.

The shipping channel itself had very few organisms. The channel consisted largely of oyster shell fragments. The organism most commonly found was the polychaete *Marphysa sanquinea*.

The two polychaetes, *H. filiformis* and *S. benedicti* are both tube builders or sedentary forms, and may require certain sediment sizes for tube building. Other tube building polychaetes are *A. elongata*, *P. ligni*, *Pseudopolydora kempi* and *Scolelepis squamatus*. The remaining polychaetes are "free-living" and do not build tubes. The majority of polychaetes are detritus feeders, with *G. polygnatha*, *Eteone lighti*, *E. californica* and *N. succenea* being predators. The bivalves collected in South Bay, with the exception of the species of *Macoma*, have short siphons and remain in the top few cm of substrate. Representatives of the genus *Macoma* can burrow down 1.0 m below the surface and can be quite mobile. *M. senhousia* builds nests, but at the same time can be highly mobile. The mobility of *G. gemma*, *L. californica* and *Tapes japonica* is not known.

The quantitative data analysis is concerned with the four representative species. The abundance data for these species are summarized in Fig. 7 - 11. Mean abundances of all species at all stations declined from October, 1975 to January, 1976. *L. californica* at stations 6,18, and 19, had similar abundance fluctuation patterns, with mean abundances that decreased steadily from October to May, then increased in August. *M. senhousia* at stations 12 and 13, had mean abundances that gradually increased after January. *M. inquinata*

Fig. 7

Gemma gemma

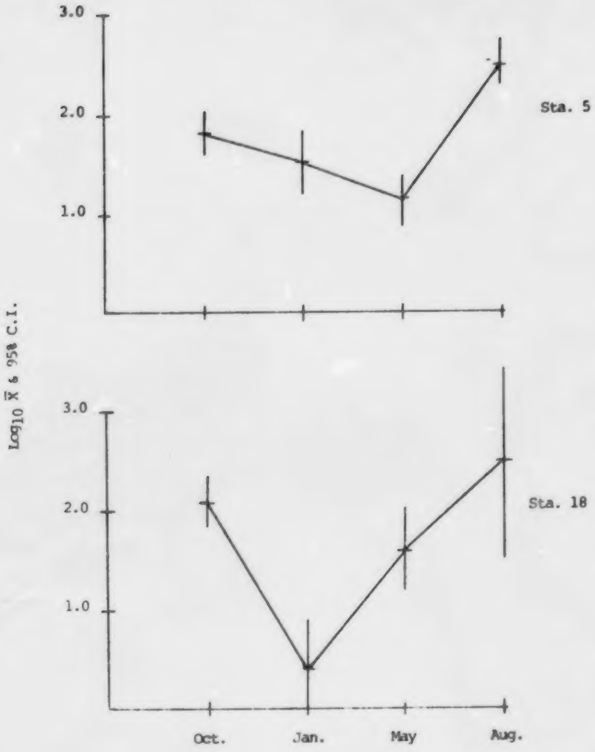


Fig. 7 cont.

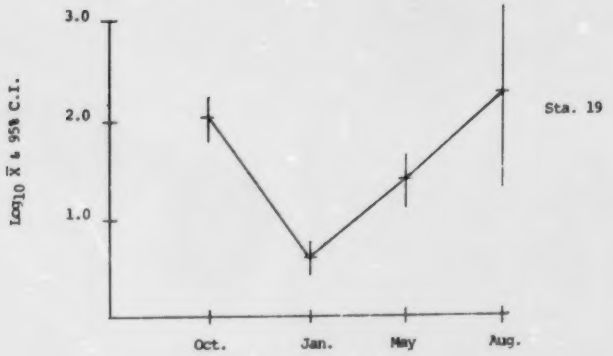


Fig. 8

Heteromastus filiformis

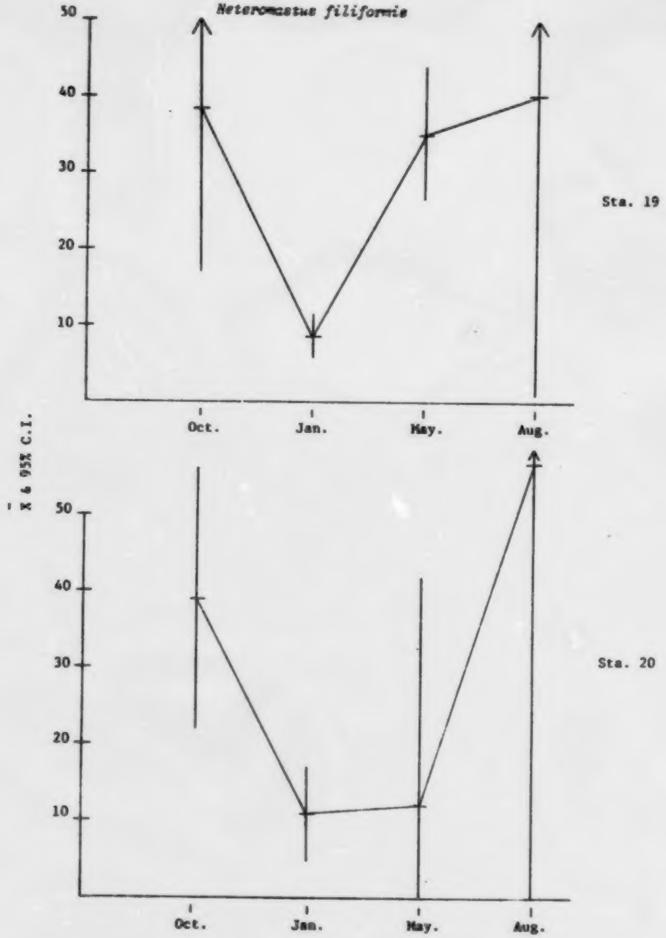


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Fig. 8 (cont.)

Heteromastus filiformis

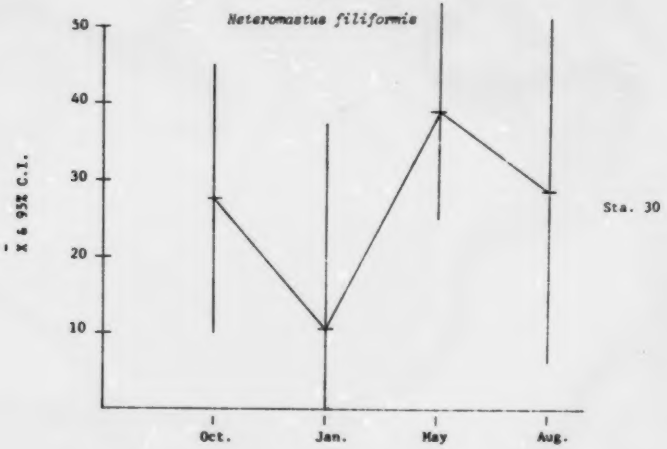


Fig. 9

Macoma inquinata

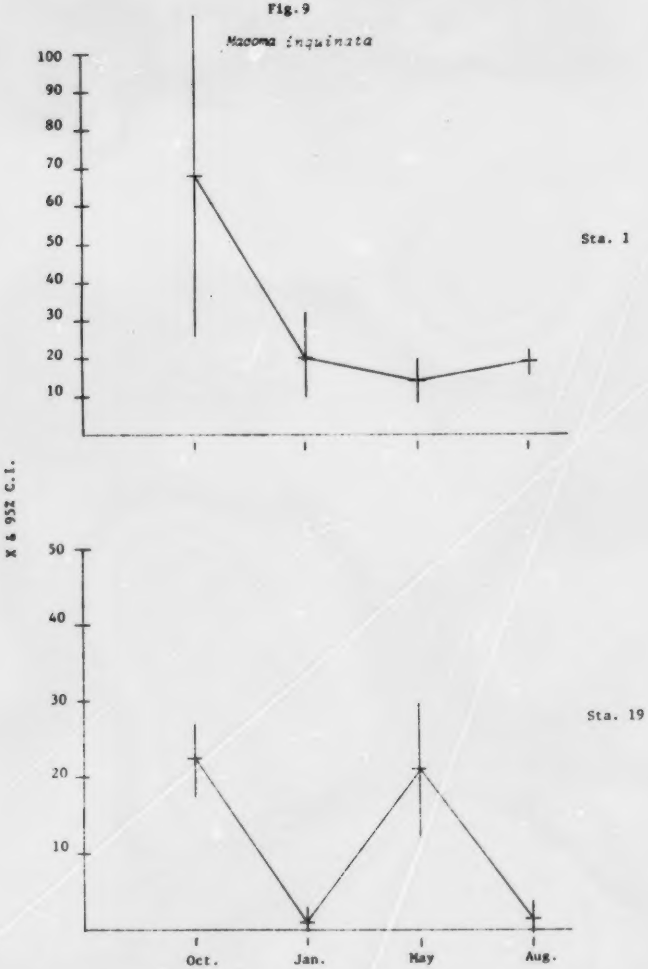


Fig. 10

Musculus senhousia

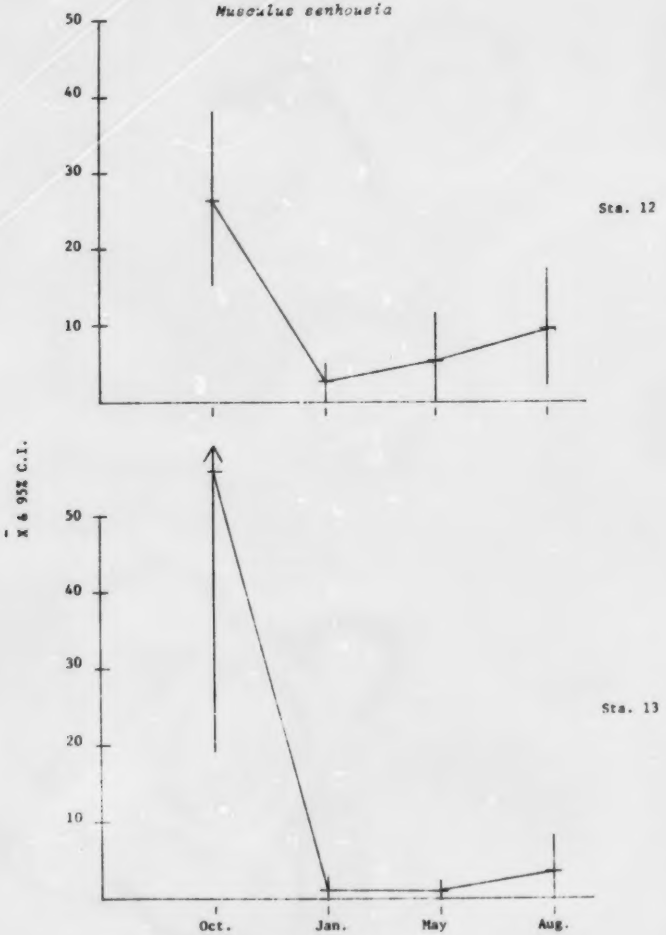
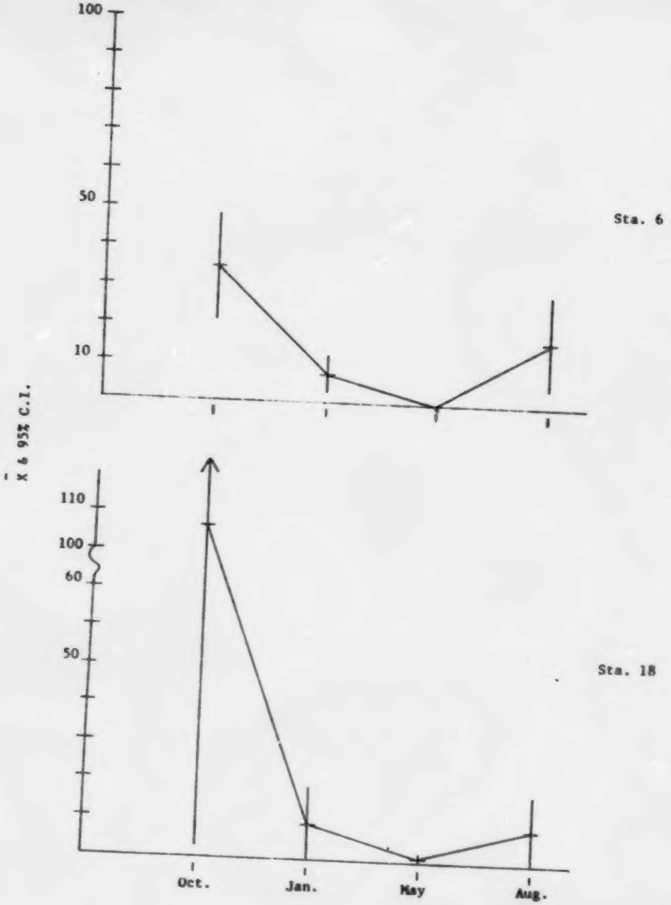


Fig. 11

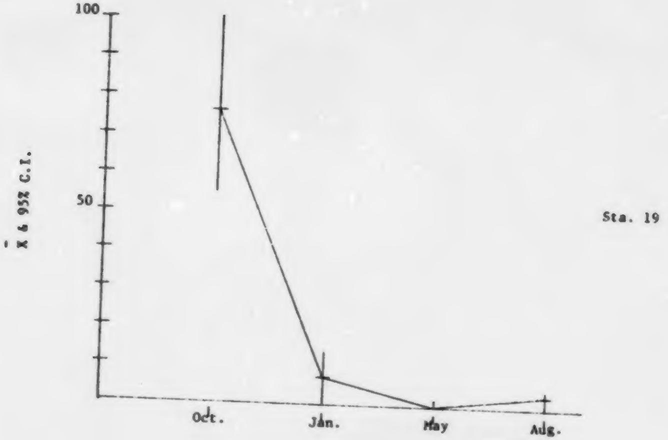
Lyonsia californica



H-176

Fig. 11 (cont.)

Lyonsia californica



at station 1 had abundance fluctuations similar to *L. californica*, but the abundance changes at station 19 were substancially different. *N. filiformis* at station 19,20, and 20, and *G. gemma* at stations 5,18, and 19 had abundance fluctuations that differed between stations. These figures suggest two different types of abundance fluctuation patterns. 1) Those abundances that change similarly between stations-*L. californica* and *M. senhousia*, and 2) those species abundance which fluctuate differently between stations-*H. filiformis*, *M. inquinata*, and *G. gemma*; in this case, both types have species abundances that fluctuate significantly over time.

Measurements of the four selected bivalves for size class analysis have been performed, and length-frequency diagrams for the bivalves are shown in Appendix V . The diagrams for *G. gemma* (Figs. 1-3) clearly shows that animal size increases throughout the three sampling periods. These figures indicate that *G. gemma* reproduces in late summer or early fall because of the increased percentages of small sized classes in October, and the near absence of small size classes in May. The August samples have not been completely measured due to the large numbers of individuals. However, observations on the high numbers of small individuals appear to confirm the late summer reproduction time. The *M. inquinata* diagrams (Figs. 4-5) show some size differences between stations 1 and 19. Station 19 clearly shows recruitment in the fall, and a gradual increase in size or growth into spring. There were too few animals collected in August for any comparison.

Station 1 however, does not show fall recruitment: May and August size class data are very similar, suggesting little or no growth. The *M. senhousia* population at both stations 12 and 13 substancially decrease after October, making interpretation of size class data difficult. From October, 1975 to August, 1976 there is a substancial increase in size at both stations. The *L. californica* population follows the same overall growth pattern as *M. senhousia*, i.e. between October, 1975 and August, 1976 there was a substancial size increase of the individuals present.

The polychaete, *N. filiformis*, and the amphipod, *A. milleri*, have not been measured due to difficulties in obtaining accurate measurements. The typical size measurements for polychaetes is the number of setigers. However, there were very few individuals with whole bodies for setiger counts. There was not enough time to regress anterior measurements to setiger number so the rest of the individuals could be counted. Similar difficulties were encountered with *A. milleri*. Partial and badly bent bodies made length measurements unreliable.

Combining the abundance data and the size class data revealed three general groupings of bivalves. Grouping "A" were those species that had similar abundance fluctuations and growth patterns between stations, in this case, *L. californica* and *M. senhousia*. There was a significant increase in size for both species after a substancial decrease in abundance, which suggests that emmigration occurred. If emmigration did occur, it is not known whether the species dispersed over a large area or simply emmigrated to another location. Another explanation for the significant abundance changes may have been our inability to accurately re-locate the vessel in the same position for each station. The size class data for both species showed no clear time of reproduction. It is not know whether the species reproduces once a year, or not. Reproduction may, or may not, be density dependent.

Group "B" were those species that had different abundance fluctuations between stations, but that had similar growth patterns between stations. *G. gemma* is the species in this group. Growth for this group is evidently related to some factor that affected the different stations at the same time. This factor could be physical, seasonal, or density dependent.

M. inquinata represents Group "C", where abundance fluctuations and growth patterns both differed between stations. Evidently there are a variety of factors affecting *M. inquinata* populations. It is also possible that the physical and/or biotic environment affecting *M. inquinata* at station 1 is substancially different from station 19, so that we may be dealing with two *Macoma* populations.

It should be noted that these species-growth groupings have been for descriptive purposes, and are not to be considered as established associations. Further quantitative data analysis

and possibly more sampling would be required before any such groupings could be finalized. Cursory as these groupings may be, they do offer some initial catagorization of the fauna for future discussion and sampling program design.

D. Ponar Grab Efficiency

The selection of the Ponar grab (0.5 m^2) was based upon the weight of the grab and the ease and safety of use from a small craft. The South San Francisco Bay is largely a shallow water area, with some of the faunal stations accessible only at high tide. This limitation necessitated the use of a small craft and light sampling equipment.

D.1 - Replicate Analysis

The fauna collected by four replicate samples at each station was analyzed for grab precision in several ways. Again, the October, 1975 samples were used for these analysis. The pooled number of species and individuals for each replicate are shown in Fig . 12 . The results from pooling the data indicate that one replicate sufficiently estimates combined species and individuals as well as four replicates.

However, since the objective of the study is to monitor selected species, these representative species and their respective stations (October, 1975) were analyzed individually for replicate precision (Table X). The samples were grouped into 2, 3, and 4 replicates for the analysis (sets AB, ABC, and ABCD). Based upon Table X three replicates per station would be the minimal for obtaining needed quantitative data for the study and four replicates would yield a more accurate analysis of the representative species populations.

The use of a larger sampling device in aggregate populations

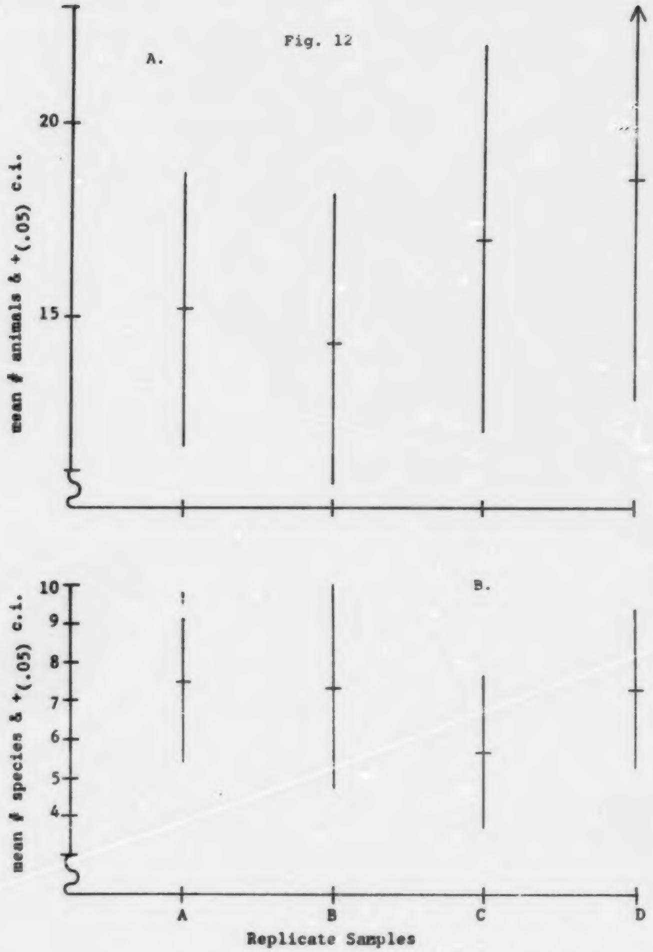


Fig. 12

will increase the probability of increased numbers of rare species, and probably increase the mean values of species abundance. A larger grab will also, concurrently, increase the probability of a higher standard error of the mean. A higher standard error of the mean can cause the data to become less sensative to minor changes in abundance patterns. The use of more replicates at each station may diminish the standard error to a relatively constant value. The magnitude of the error factor is dependent upon the type of faunal distribution in space. Due to the cost of analyzing each sample, more than four replicates per station for 15 stations for three more sampling periods was outside the financial limits of the contract.

D.2 - Volume Analysis

The effect of different grab volumes on obtaining higher species numbers was tested by correlation using the product moment correlation coefficient for the representative species collected in October, 1975. Different transformation of the species abundance raw data were used to obtain the highest correlation coefficients. Of the six representative species tested, *H. filiformis*, *M. inquinata*, and *G. gemma* had significant correlation coefficients (Fig. 13). Based on the exsisting sampling program and the presented correlations, to maintain sufficient animal densities per grab, the recommended minimum volume is 3.0 liters.

Fig. 13

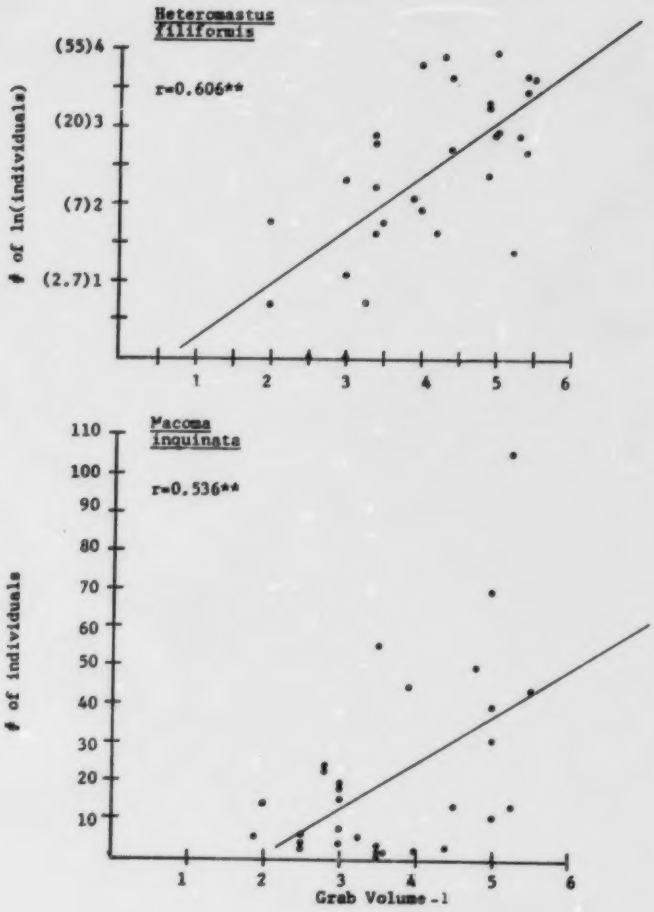
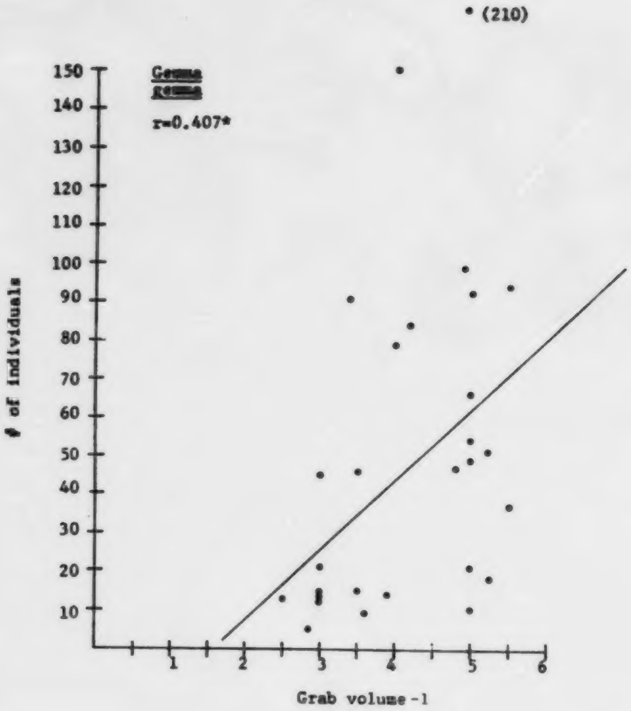


Fig. 13 cont.



IV DISCUSSION

The results of the sieving experiment showed that the faunal samples should be preserved before sieving, if it is important to characterize the abundance of small forms, because numerous smaller individuals may pass through the 0.5 mm screen size. Therefore, the selection of screen sizes for sieving can be important, particularly if detailed information on population changes or juvenile size data of certain species is required. This may, in fact, require a variety of screen sizes, and depending on species abundances, different sampling programs for each species. Depending on the abundance of a species, fewer or more, larger or smaller samples may have to be taken to estimate fecundity, size distribution, or some other variable. Part of the criteria for selecting the sieve screen size should depend upon the species to be studied, and the type of information required for those species. These two considerations must be based upon the questions which the sampling program is designed to answer.

The selection of the time frequency for sampling, type and size of grab, and the sieve screen size must depend upon the species selected for study. In this study, the frequency of sampling was established before the selection of species. In some cases more frequent sampling would have given a more precise insight to growth rates and size frequencies. Therefore, we would suggest that in the future, the frequency of sampling be established after the selection of the species to be studied.

This study has revealed the need for the improvement of sediment analysis and the process of re-location of the vessel during sampling. The data has shown that wet sieving sediment samples yields a more realistic sizing of sediment particles. If detailed knowledge of animal-sediment relationships are required, then an accurate description of sediment size is essential. In recent studies we have found that most small scale sediment changes take place in the finer fractions, therefore, more accurate analysis of the finer fraction must be made.

In general, the objective of performing a baseline ecological study is to provide background information of the fauna in respect to natural abundance fluctuation, species growth, fecundity and distribution. In addition, tenative associations between different species, and species with physical and/or biotic factors may be made. The data analysis performed in this report is one method to satisfy the aforementioned objectives of a baseline study. The South Bay fauna was described in two ways. The area was divided into four major species-location groups to characterize the species distributions. The major species, selected from the initial sampling period, were then divided into associations of similar and dissimilar changes in abundance and growth patterns. These associations and groupings can then be examined in detail in future studies to determine if they do, in fact, exist over a period of time.

This data can be used as baseline information for the invertebrate infauna in South Bay. Studies done in the future can then compare data to observe if any significant changes in the invertebrate community has occurred.

References Cited

Hessler, Robert R., and Peter A. Jumars, 1974. Abyssal community analysis from replicate box cores in the central North Pacific. Deep Sea Res. 21: 185-209.

Mason, Curtis C. and Robert L. Folk, 1958. Differentiation of beach, dune, and aeolian flat environments by size analysis, Mustang Island, Texas. J. Sed. Pet. 28: 211-226.

Muus, Kirsten, 1973. Settling, growth, and mortality of young bivalves in the Øresund. Ophelia 12: 79-116.

Reish, Donald J., 1959. A discussion of the importance of the screen size in washing quantitiative marine bottom samples. Ecology 40: 307-309.

Smith, E.H., 1975. Animal-sediment relationship in Bays and estuaries. Fed. Est. Assoc. (in press).

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Dr. James Blake, Pacific Marine Station. Identification and assistance in the counting of the polychaetes.

Dr. Scott Gray, Environmental Services Section - Bechtel. Identification and assistance in the counting of the amphipods.

Mr. David R. Williams, E.H. Smith & Associates. Statistical analysis and assistance in the field and laboratory work on the project.

Appendixes for the
Final Report on the
South Bay Dischargers
Authority
Wastewater Disposal Project

Benthic Survey and Water Quality
Sampling Program

Submitted to
Environmental Services Section
Bechtel

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January 31, 1977

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Appendix I

Table 1

Tidal Cycle on Benthic Sampling Dates

Stations 1-17 were obtained on October 4-5, 1975. Stations 18-30 were obtained on October 18, 1975. The following is a listing of the tidal cycle:

		High Tide		Low Tide	
	Date	Time	Ht.	Time	Ht.
October 1975	10/4	1218	2.71 m	1915	0.00 m
	10/5	1259	2.87 m	1959	0.15 m
	10/18	1205	2.49 m	1853	0.18 m
January 1976	1/24	622	2.65 m	1325	0.70 m
May 1976	5/1	1400	2.19 m	0851	-0.09 m
August 1976	8/18	0845	1.95 m	1352	-0.39 m

Appendix I cont.

Table 2

Benthic - Sampling Data

October 4, 5 and 18, 1976

Sta.	Time	Depth	Volume - 1 A	B	C	D
1	1200	3.05 m	3.50	5.00	5.25	5.50
2	1245	3.05 m	2.80	2.50	2.00	2.80
3	1330	2.44 m	4.00	5.00	5.00	5.50
4	1700	2.59 m	3.90	4.80	5.00	
5	1730	0.91 m	5.25	4.00	3.50	
6	1820	1.68 m	3.25	3.00		3.00
7	840	9.45 m	4.90	2.50	0.70	2.50
8	930	11.89 m		1.75	3.00	4.75
9	1030	0.91 m	3.00	2.75	3.00	3.50
10	1110	0.91 m	4.90	3.00	2.40	4.90
11	1145	0.91 m	4.40	1.90	4.00	2.50
12	1320	0.91 m	2.50	3.50	3.60	3.00
13	1405	2.13 m	2.50	2.00	4.00	2.20
14	1450	3.66 m	4.50	3.50	3.00	2.50
15	1540	0.91 m	5.25	5.00	3.00	5.00
16	1615	7.32 m	4.80		4.00	4.40
17	1700	2.13 m		2.70	3.00	
18	910	1.52 m	4.90	4.90	4.20	5.50
19	925	0.91 m	3.40	4.00	5.00	5.00
20	955	0.91 m	3.40	4.40	4.30	5.40
21	1020	1.52 m	4.90	4.40	5.40	5.40
22	1045	1.52 m	3.40	3.40	3.90	5.30

Table 2 cont.

Benthic - Sampling Data

Sta.	Time	Depth	A	Volume - 1 B	C	D
23	1115	6.09 m	3.00	2.90	1.60	2.50
24	1140	7.62 m	2.00	2.10	1.00	2.20
25	1245	3.66 m	4.00	4.10	5.50	4.00
26	1305	2.13 m	3.60	4.00	3.00	4.10
27	1340	2.74 m	2.00	2.10	2.20	2.10
28	1400	14.94 m	4.10	3.40	4.10	4.10
29	1420	3.35 m	5.50	4.40	5.50	5.30
30	1430	1.52 m	3.40	3.40	5.40	3.60

Appendix I cont.

Table 3

Benthic - Sampling Data

1/24/76

Sta.	Time	Depth m	Volume - 1 A	B	C	D
1	1600	1.0	5.00	4.00	5.00	5.00
5	1645	1.0	5.00	5.00	5.50	5.00
7	930	11.38	3.00	2.50	3.50	2.75
8	1025	11.69	4.00	5.00	4.00	4.00
9	1000	1.0	3.50	4.50	3.50	4.00
10	1050	3.4	3.50	5.50	5.50	4.50
11	1110	1.0	4.00	5.00	5.00	5.00
12	1145	3.0	6.00	5.00	4.00	5.00
13	1205	1.0	4.00	4.50	4.00	4.00
18	1340	1.5	5.50	5.00	5.50	5.00
19	1400	1.0	5.00	5.50	5.50	5.00
20	1725	1.5	4.00	4.00	4.00	3.50
25	1710	2.2	5.00	4.00	4.00	4.00
30	1800	1.0				

Appendix I cont.

Table 4

Benthic - Sampling Data

5/1/76

Sta.	Time	Depth m	Volume - 1 A	B	C	D
1	1730	1.0	4.00	4.00	5.00	4.00
5	1750	1.0	4.50	4.00	4.50	4.50
6		1.0	5.00	5.00	4.50	5.00
7	1200	11.5	5.00	5.00	4.50	3.75
8		11.5	3.00	4.00	5.00	4.00
9	1315	1.0	3.00	3.00	3.00	3.50
10	1245	3.0	4.00	4.00	3.75	3.00
11	1410	1.0	5.00	4.00	4.50	5.00
12		3	5.00	5.50	4.00	5.00
13		1.0	4.00	5.00	3.00	5.00
18	1630	1.0	4.00	4.50	4.00	4.00
19	1700	1.0	5.00	5.00	5.00	4.00
20		1.0	5.00	5.00	4.75	4.00
25	1830	1.0	3.50	5.00	4.50	4.00
30	1905	1.0	5.00	5.00	5.00	4.00

Appendix I cont.

Table 5

Benthic - Sampling Data

8/18/76

Sta.	Time	Depth m	Volume - 1 A	B	C	D
1	1625	1.3	5.50	5.50	4.50	5.50
5	1650	1.3	5.50	5.50	5.50	5.50
6	1710	1.5	5.50	5.50	5.50	5.50
7	1045	7.5	5.50	5.50	4.50	4.50
8	1055	9.0	5.50	5.50	5.50	5.00
9	1115	2.4	5.50	5.50	5.50	5.00
10	1135	2.4	5.50	5.50	4.50	5.00
11	1335	1.5	5.00	5.00	5.00	4.50
12	1220	3.0	5.50	5.50	5.50	5.50
13	1425	2.1	4.00	4.00	5.00	5.00
18	1450	1.3	5.50	5.50	4.00	4.50
19	1500	0.3	5.50	5.50	5.50	5.50
20	1345	1.2	5.50	5.50	4.50	5.50
25						
30	1800	1.3				

Appendix I cont.

Table 6

Benthic - Water Quality

10/4-5-18/75

Sta.	D.O.	% D.O. Sat.	Temp. C°	Chlorinity mg/1	Salinity ppt.	Turbidity FTU
18				15036	26.68	16.0
19	7.47	98.71	17.0	14772	26.21	11.0
20	7.05	93.60	17.0	14640	25.99	8.3
21	7.11	81.82	17.0	14113	25.06	18 0
22	6.90	79.31	17.5	14003	24.87	6.0
23	7.98	93.01	17.0	15168	26.91	5.8
24	7.93	95.12	17.0	14651	26.00	5.2
25	7.58	90.56	17.8	14288	25.38	6.3
26	8.73	106.08	18.0	14.113	25.06	6.5
27	9.61	107.50	18.0	15497	26.25	4.9
28						
29	9.27	113.46	17.5	14772	27.17	7.8
30	8.56	104.90	18.1	14794	26.25	9.0

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Turbidity was determined by the Nephelometric Method (Standard Methods, 13th edition) and reported in Formazin Turbidity Units (FTU).

Appendix I cont.

Table 7

Benthic - Water Quality

1/24/76

Sta.	D.O. ppm	%D.O. Sat.	Temp. C°	Chlorinity mg/l	Salinity ppt	Turbidity FTU
1	5.7	68.67	13.5	6010	10.81	53
5	7.5	88.24	13.7	11780	20.99	29
6	8.07	93.38	11.5	12990	23.11	30
7	9.32	103.60	10.0	14795	26.26	2.0
8	8.25	91.64	9.90	14640	25.99	3.1
9	8.62	95.82	10.0	14750	26.18	15
10	8.36	92.89	10.1	14580	25.88	7.8
11	7.78	86.36	10.7	14380	25.53	3.7
12	8.30	92.18	11.5	14170	25.17	3.3
13	7.29	94.61	12.5	13550	24.09	14
18	7.36	95.58	12.5	14000	24.87	5.4
19	7.89	95.06	13.5	14170	25.17	5.5
20	6.00	73.28	11.8	13750	24.44	22
25	7.69	92.65	11.0	13700	24.35	10.1
30	8.01	97.24	10.0	13875	24.65	9.0

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Turbidity was determined by the Nephelometric Method (Standard Methods, 13th edition) and reported in Formazin Turbidity Units (FTU).

Appendix I cont.

Table 8

Benthic - Water Quality

5/1/76

Sta.	D.O. ppm	%Sat. D.O.	Temp. C°	Chlorinity mg/l	Salinity ppt.	Turbidity NTU*
1	6.26	80.67	21.5	10444	18.8	
5	4.46	58.26	25.5	11611	20.9	85
6	6.47	80.22	23.8	12611	22.7	65
7	7.37	86.03	16.8	14333	25.8	50
8	7.41	89.22	16.75	14944	26.9	70
9	7.31	84.89	17.0	14888	26.8	90
10	7.89	91.27	16.5	14555	26.2	60
11	7.91	92.45	17.0	14444	26.0	90
12	7.51	90.42	17.0	14944	26.9	
13	7.34	85.90	15.5	15555	28.0	100
18	7.57	90.42	23.0	13277	23.9	
19	7.83	95.20	24.0	13055	23.5	250
20	7.52	95.61	19.0	13722	24.7	
25	6.76	81.89	24.0	13833	24.9	110
30	6.28	75.89	25.0	12500	22.5	120

*NTU - Nephelometric Turbidity Units

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Appendix I cont.

Table 9

Benthic - Water Quality

8/18/76

Sta.	D.O. ppm	%Sat. D.O.	Temp. C°	Chlorinity mg/l	Salinity ppt.	Turbidity NTU*
1	2.85	36.31	21.7	10500	18.9	16.0
5	6.09	82.31	22.0	16200	29.1	5.6
6	5.97	81.51	21.1	17200	30.9	----
7	6.72	92.97	20.8	18400	33.1	2.5
8	6.89	95.85	20.6	18900	34.1	1.9
9	6.28	87.56	20.1	19100	34.3	2.1
10	6.87	95.95	20.4	19200	35.5	3.0
11	6.78	93.80	21.2	18400	33.1	2.5
12	6.79	94.46	20.7	18900	34.0	2.3
13	6.78	93.08	21.8	17700	31.8	----
18	4,56	62.60	20.5	17700	31.9	4.7
19	5.07	68,77	23.0	16600	29.9	7.4
20	6.48	89.06	22.1	17800	32.1	6.0
25						2.0
30	6.71	91.82	21.7	17400	31.3	2.1

*NTU - Nephelometric Turbidity Units

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland & Parsons.

Appendix II

Table 1

Tidal Cycle on Water Quality Sampling Dates

	Date	High Tide Time	High Tide Ht.	Low Tide Time	Low Tide Ht.
October 1975	10/17	1653	1.82m	1121	0.94m
March 1976	3/16	1252	2.53m	1838	0.12m
July 1976	7/8	1156	2.16m	1617	0.79m
November 1976	11/12	1502	2.32m	2225	0.06m

Appendix II cont.

Table 2

Water Quality Field Data

10/17/76

Sta. #	Depth m	D.O. mg/l	%D.O. Sat.	ph*	Chlorinity mg/l	Salinity ppt	Temp. C°
A	1.95	3.60	45.57	6.30	16290	28.85	22.90
B	2.60	4.50	54.22	6.20	11520	20.54	20.50
C	1.50	4.90	59.04	6.50	10810	19.29	21.40
D	2.44	5.29	64.51	6.60	11360	20.26	21.20
E	2.60	4.29	51.17	6.59	10650	19.01	21.50
F	4.55	5.51	68.02	6.59	12760	22.71	21.20
G	3.90	5.40	65.85	6.55	11700	20.85	21.40
H	2.00	6.05	73.78	6.70	13020	23.16	21.00
I	2.00	6.40	80.00	6.80	13940	24.77	21.00
J	6.00	6.80	85.00	6.50	14640	25.99	20.75
K	3.00	6.80	85.00	6.20	14440	25.64	21.75
L	Surface	6.90	86.25	6.30	14320	25.43	21.00
M	5.64	7.65	89.36	6.20	15519	27.51	17.00
N	8.69	7.62	90.50	5.90	15783	27.97	16.00
O	1.00	7.59	89.40	6.40	15695	27.83	17.00
P	7.16	7.33	85.93	6.80	15695	27.83	17.00
Q	4.11	7.62	89.43	6.60	15872	28.05	17.00
R	1.00	7.04	82.43	6.90	15607	27.67	17.00
S	0.50	8.97	108.47	7.10	15322	27.17	17.00
T	8.67	7.72	90.61	7.10	15827	28.05	17.00

Appendix II cont.

Table 2 cont.

Sta. #	Depth m	D.O. mg/l	%D.O. Sat.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
U	5.64	7.63	89.46	7.30	15651	27.74	17.00
V	0.50	7.66	89.46	7.40	15376	27.27	17.00
W	10.21	7.52	92.60	7.50	15364	27.24	17.50
X	5.64	7.51	92.60	7.60	15431	27.36	17.50
Y	0.50	7.50	92.57	7.60	15497	27.48	17.50
Z	7.16	7.51	92.60	7.60	15475	27.44	17.50
AA	4.11	7.52	92.61	7.60	15300	27.13	17.50
BB	0.50	7.52	92.61	7.60	15387	27.29	17.50

Chlorinity was determined by the Argentometric Method (Standard Methods, 13th edition, page 377).

Salinity was calculated by the chlorinity conversion formula in Strickland and Parsons.

* ph values are low due to a damaged electrode

Appendix II cont.

Table 3

Water Quality Field Data

3/16/76

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
A	2.0	9.63	111.59	8.35	11722	21.10	15.7
B	2.3	9.48	110.49	8.39	12166	21.90	15.1
C	3.0	11.252	133.13	8.45	12277	22.10	16.0
D	3.4	10.42	122.30	8.55	12833	23.10	15.1
E	2.2	11.238	130.86	8.42	11777	21.20	16.0
F	2.5	12.05	140.94	8.6	12500	22.50	16.0
G	6.2	11.398	166.47	8.6	12777	23.0	15.5
H	2.2	13.02	149.31	8.67	12777	23.0	15.5
I	1.8	11.96	138.12	8.6	13444	24.2	15.0
J	Surface	11.06	127.71	8.4	13388	24.1	15.0
K	6.23	10.91	126.71	8.32	13888	25.0	14.3
L	8.23	10.21	118.58	8.29	13888	25.0	14.1
M	Surface	10.23	132.34	8.35	13333	24.0	15.0
N	3.15	10.01	129.83	8.35	13611	24.5	14.5
O	5.15	9.89	128.61	8.35	13888	25.0	14.5
P	Surface	10.66	123.09	8.4	13388	24.1	15.7
Q	9.3	9.74	112.73	8.37	13611	24.5	14.5
R	11.3	10.22	117.20	8.37	13777	24.8	14.3
S	Surface	10.75	122.86	8.41	13500	24.3	14.7
T	Surface	11.54	132.04	8.5	13555	24.4	14.5
U	13.9	10.32	118.35	8.39	13833	24.9	14.2
V	15.9	10.61	121.81	8.39	13888	25.0	14.2

Table 3 cont.

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Chlorinity mg/l	Salinity ppt	Temp. C°
W	Surface	11.02	127.84	8.45	13833	24.9	14.2
X	3.15	10.52	122.04	8.41	13777	24.8	14.1
Y	5.15	10.92	126.68	8.43	13777	24.8	14.2
Z	Surface	10.53	123.45	8.40	13722	24.7	14.2
AA	3.15	10.01	119.02	8.38	13888	25.0	14.1
BB	5.15	9.52	113.06	8.30	13833	24.9	14.1
CC*	Surface	10.24	118.52	8.6	13611	24.5	14.7

*Location - In line with R16 and first salt flat, next to double stakes.

Appendix II cont.

Table 4

Water Quality Field Data

7/8/76

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Clorinity mg/l	Salinity ppt	Temp. C°
A	1	4.09	53.53	8.36	8444	15.2	29.9
B	1	3.09	40.95	8.41	9500	17.1	28.9
C	1	6.87	94.50	8.18	11444	20.6	29.2
D	1	4.125	56.94	8.19	12833	23.1	29.3
E	1	4.45	58.17	8.18	11666	21.0	27.0
F	1	5.11	67.86	8.30	14111	25.4	24.2
G	1	5.68	73.05	8.21	15833	28.5	22.8
H	1	5.81	74.87	8.11	16000	28.8	21.8
I	1	6.56	82.41	8.09	17111	30.8	20.1
J	1	7.25	94.22	8.29	16722	30.1	21.2
K	8	7.30	94.87	8.25	16722	30.1	21.0
L	15	7.1	92.21	8.11	16666	30.0	20.9
M	7	6.93	90.29	8.09	15833	28.5	20.5
N	3	6.56	84.92	8.21	15277	27.5	21.0
O	1	6.47	85.24	8.30	16777	30.2	21.0
P	9	7.41	92.51	8.25	16555	29.8	20.5
Q	4.5	7.51	94.05	8.31	16833	30.3	20.5
R	1	7.32	91.61	8.23	16777	30.2	20.9
S	1.5	6.2	75.15	8.19	17222	31.0	19.5
T	1m	7.21	93.70	8.37	16722	30.1	21.2
U	9	7.39	96.10	8.31	16777	30.2	20.8
V	15	7.405	96.11	8.35	16611	29.9	20.5

Appendix II cont.

Table 4 cont.

Sta.	Depth m	D.O. ppm	%Sat. D.O.	ph	Clorinity mg/l	Salinity ppt	Temp. C°
W	9	8.05	101.96	8.21	16722	30.1	20.9
X	4.5	8.49	107.60	8.19	16777	30.2	20.9
Y	1	7.94	101.08	8.32	17166	30.9	20.5
Z	5	7.15	89.43	8.11	16722	30.1	21.1
AA	2.5	7.0	87.50	8.35	16666	31.0	20.5
BB	1	6.98	87.54	8.34	16888	30.4	20.8
CC	1	5.48	71.26	8.2	15666	28.2	23.7

Appendix II cont.

Table 5

Water Quality Field Data *

11/12/76

Sta.	Depth m	D.O. ppm	D.O. °C	Cal ppm	ph	Temp. °C
A	1	5.8	16	8.0	8.3	15.0
B	1	5.8	16	8.0	8.2	15.0
C	1	6.4	16	8.0	8.2	15.2
D	1	6.4	16	8.0	8.1	15.5
E	1	6.1	16	8.0	8.2	15.5
F	1	6.6	16	8.0	7.8	15.3
G	1	6.8	16	8.0	8.3	15.5
H	1	7.2	16	8.0	8.3	15.5
I	1	7.3	16	8.0	8.3	16.0
J	7	7.0	18	7.4	7.6	16.0
H	4	6.9	18	7.4	7.6	15.8
L	1	6.9	18	7.4	7.6	15.8
M	5	6.7	15	8.1	7.0	15.9
N	8	6.7	15	8.1	6.8	15.9
O	1	6.3	15	8.1	7.2	15.5
P	8	7.2	15	8.1	7.5	15.5
Q	5	7.1	15	8.1	7.5	15.3
R	1	6.9	15	8.1	7.5	15.3
S	1	7.6	15	8.1	7.4	15.9
T	16	7.1	15	8.1	7.6	15.8
U	9	7.1	15	8.1	7.6	15.8

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Appendix II cont.

Table 5 cont.

Sta.	Depth m	D.O. ppm	D.O. °C	Cal. ppm	ph	Temp. °C
V	1	7.0	15	8.1	7.6	15.3
W	8	6.9	18	7.7	7.6	15.8
X	5	6.8	18	7.7	7.6	15.5
Y	1	6.8	18	7.7	7.6	15.5
Z	6	7.5	17	7.8	7.6	15.3
AA	4	7.4	17	7.8	7.6	15.3
BB	1	7.4	17	7.8	7.6	15.5
CC	1	6.8	20	7.4	7.7	16.0

* The values for salinity and chlorinity are listed in the laboratory analysis from the Pacific Environmental Laboratory. The D.O. values listed are not corrected for actual chlorinity.

Appendix III

Table 1

Dry Sieved Analysis

Percent Sand Size - By Weight

9/1/75

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
1	15.450	11.332	14.717	36.939	18.396	2.575	0.589
2	22.267	5.263	17.814	10.121	6.073	6.073	32.388
3	25.316	11.685	22.395	22.882	11.685	3.700	3.894
4	69.587	7.850	19.771	2.229	0.349	0.019	0.194
5	33.499	11.185	20.937	19.008	9.091	0.331	2.975
6	25.926	11.852	20.741	27.259	8.963	3.333	1.926
7	29.863	9.036	14.124	9.039	15.335	15.335	7.264
8	96.774	0.101	0.504	0.403	0.101	0.101	2.016
9	12.207	12.207	16.439	16.276	23.177	14.974	4.720
10	10.791	15.481	18.087	14.868	31.116	7.511	2.146
11	17.702	16.459	19.409	32.298	11.242	1.801	1.553
12	3.956	22.101	23.192	28.922	16.508	3.956	1.364
13	6.093	19.572	19.572	12.851	31.019	9.047	1.846

Appendix III cont.

Table 2

Wet Sieved Analysis

Sediment Analysis - Percent Sand Size by Weight

10/4-5-18/75

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
1	1.183	1.359	1.805	7.593	1.037	2.033	85.000
2	4.025	0.767	1.648	5.443	1.546	2.044	78.840
3	3.170	1.423	4.552	8.739	2.032	3.224	76.819
4	2.459	1.031	3.435	7.377	1.916	2.025	81.757
5	1.404	0.146	4.621	6.303	1.536	1.404	84.587
6	0.590	1.789	4.679	8.925	4.954	2.123	80.520
7	13.707	0.952	6.854	7.953	2.240	1.448	68.160
8	2.145	0.728	4.938	5.666	5.785	4.091	76.648
9	1.624	0.874	5.678	11.356	11.742	12.832	55.894
10	2.139	1.134	1.924	12.102	0.373	6.288	76.041
11	0.939	0.122	5.963	12.279	14.498	14.364	51.725
12	1.381	0.705	1.777	7.065	1.998	7.344	79.686
13	5.538	1.282	1.794	11.179	4.333	8.846	67.026
14	4.518	2.170	4.269	7.115	3.959	4.767	73.212
15	0.619	0.380	2.240	5.749	0.014	3.283	85.755
16	0.803	0.233	2.279	8.691	2.487	3.316	82.191
17	-	-	-	-	-	-	-
18	2.524	1.017	6.955	6.729	1.783	2.825	78.167

Appendix III cont.

Table 2 cont.

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
19	1.929	0.261	7.741	5.103	1.705	3.199	80.062
20	1.936	1.416	11.242	7.091	1.646	1.779	74.891
21	1.566	4.530	10.542	6.164	3.486	4.968	68.744
22	3.232	0.715	1.609	7.000	2.130	3.232	82.082
23	47.157	1.711	3.889	6.412	1.698	2.461	40.094
24	43.987	14.398	5.379	5.9.27	0.923	1.428	25.564
25	2.510	0.363	4.730	9.504	1.741	3.424	77.728
26	8.602	1.404	5.318	5.485	1.249	2.614	75.328
27	44.953	2.361	3.723	6.850	5.008	3.204	33.500
28	2.210	1.214	10.617	6.771	2.555	3.398	73.234
29	2.509	0.271	3.753	6.387	2.929	7.459	76.702
30	6.445	0.542	2.578	8.437	5.273	5.361	71.364

Appendix III cont.

Table 3

Wet Sieved Analysis

Sediment Analysis - Percent Sand Size by Weight

1/24/76

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
1	0.301	0.186	0.945	0.817	1.089	2.163	94.499
5	1.128	1.679	4.114	1.511	2.171	2.207	87.370
6	2.222	0.771	10.751	3.121	1.927	2.171	79.037
7	35.655	1.562	2.909	3.582	1.577	1.439	53.276
8	6.921	0.197	1.899	3.292	1.815	4.755	81.123
9	5.286	0.489	0.895	4.904	4.620	0.597	83.009
10	2.210	0.513	1.654	0.428	1.670	4.835	88.719
11	0.014	0.072	1.413	1.153	1.860	15.310	80.176
12	1.962	0.276	0.124	0.290	0.373	1.670	95.274
13	2.764	0.823	0.855	1.086	1.201	5.050	88.222
18	1.147	0.110	3.112	2.216	2.892	5.313	85.209
19	2.099	0.049	0.852	1.358	1.605	3.222	89.580
20	5.598	0.481	1.499	1.609	1.527	8.775	80.512
25	1.108	0.539	0.404	1.392	1.602	4.430	90.525
30	23.550	1.761	6.156	2.892	0.716	1.518	63.407

Appendix III cont.

Table 4

Wet Sieved Analysis

Sediment Analysis - Percent Sand Size by Weight

5/1/76

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
1	3.103	2.196	3.900	2.760	2.465	7.838	77.738
5	3.692	0.953	4.459	2.091	2.898	9.263	78.378
6	1.452	2.4[illegible]	5.747	3.359	2.891	4.535	79.592
7	2.744	2.409	2.369	8.125	5.488	2.329	76.536
8	1.959	3.929	14.480	7.446	6.198	5.407	60.579
9	14.456	1.843	13.854	4.914	8.391	4.248	52.294
10	3.989	3.465	7.429	2.393	4.001	5.111	73.610
11	6.497	2.352	8.423	2.471	4.689	5.978	69.589
12	12.939	4.318	4.161	3.296	4.059	3.623	67.584
13	3.838	1.352	8.289	3.813	3.826	4.450	74.433
18							
19	3.328	1.177	4.113	2.721	1.632	3.493	83.536
20	.076	2.578	3.348	2.919	2.641	1.681	86.758
25	3.092	2.105	4.855	3.908	4.842	4.211	76.987
30	1.241	1.385	2.505	1.843	1.819	3.269	87.944

Appendix III cont.

Table 5

Wet Sieved Analysis

Sediment Analysis - Percent Sand Size by Weight

8/20/76

Sieve Openings (mm)

Sta. #	.600	.425	.250	.180	.125	.75	Less Than .75
1	2.850	0.800	1.800	0.570	0.840	1.78	91.43
5	1.560	0.730	3.930	0.550	0.770	3.09	89.38
6	0.890	0.440	2.320	2.680	0.250	1.65	91.75
7	1.530	0.570	1.320	1.240	1.060	3.14	91.14
8	0.680	0.570	0.680	1.670	1.340	7.23	87.83
9	1.680	0.230	0.930	0.650	3.170	22.54	70.79
10	0.050	0.120	0.650	0.160	0.930	2.45	95.63
11	0.270	0.650	0.600	0.680	1.410	31.20	65.78
12	0.780	0.320	0.280	0.380	0.870	1.74	93.94
13							
18	2.210	0.050	4.730	4.750	0.950	2.63	84.68
19							
20							
25							
30	1.120	0.360	1.220	0.690	2.060	1.81	92.73

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Treatment- Pres.
Station- 1C
Sub-Sample- I

Appendix IV

TABLE 1

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Macoma nasuta	1	100.00					
Heteromastus filiformis							
Streblospio benedicti	26	38.46	46.15	7.69	7.69		
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	2	100.00					
Macoma balthica	1	100.00					
Tapes japonica							
Ampelisca milleri							
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	159	7.55	27.04	43.4	11.95	5.66	2.52
TOTAL	189						

Treatment-Pres.
Station- 1C
Sub-Sample- II

Appendix IV cont.

TABLE 2

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	1			100.00			
Heteromastus filiformis							
Streblospio benedicti	30	43.33	30.00	13.33	6.67	3.33	3.33
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei	2			100.00			
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	3	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	107	22.43	28.97	30.84	9.35	6.64	1.87
TOTAL	144						

Appendix IV cont.

Treatment-Pres.
Station-1C
Sub-Sample- III

TABLE 3

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Macoma nasuta	1	100.00					
Heteromastus filiformis							
Streblospio benedicti	44	38.64	50.00	9.09	2.27		
Eteone lighti	5		60.00	20.00	20.00		
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus *senhousia*							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	3		66,67	33.33			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	87	5.75	32.18	36.78	14.94	5.75	4.60
Ostracods	5			60.00	40.00		
TOTAL	146						

Appendix IV cont.

Treatment- Pres.
Station- 1B
Sub-Sample- I

TABLE 4

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	65	20.00	40.00	33.85	6.15		
Eteone lighti	19		26.32	42.11	21.05	10.53	
Pseudopolydora kempi							
Polydora ligni	1		100.00				
Chaetozone sp.	1			100.00			
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	12	8.33	25.00	66.67			
Corophium ascherusicum	1			100.00			
Sarsiella spp.							
OLIGOCHAETEA	54	1.85	18.52	64.81	11.11	3.7	
TOTAL . . .	153						

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Appendix IV cont.

Treatment-Pres.
Station- 1B
Sub-Sample-II

TABLE 5

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENTAGE NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	3			33.33	66.67		
Heteromastus filiformis							
Streblospio benedicti	53	15.09	56.60	15.09	1.89	5.66	5.66
Eteone lighti	13		7.69	61.54	15.38	15.38	
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	4	25.00	25.00	50.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	70	2.86	12.86	47.14	21.43	10.00	5.71
TOTAL . . .	143						

Appendix IV cont.

Treatment- Pres.
Station- 1B
Sub-Sample- III

TABLE 6

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENTAGE NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	29	3.45	55.17	37.93	3.45		
Eteone lighti	2				100.00		
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	61		1.64	37.70	31.15	22.95	6.56
TOTAL . . .	94						

Appendix IV cont.

Treatment-Pres.
Station-2B
Sub-Sample- I

TABLE 7

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	9		11.11	89.99			
Heteromastu filiformis	17	94.12	5.88				
Streblospio benedicti	30	6.67	23.33	53.33	16.67		
Eteone lighti	3	33.33	33.33	33.33			
Pseudopolydora kempi	1	100.00					
Polydora ligni	2	100.00					
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	13	30.77	23.08	46.15	30.77		
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1			100.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	25		12.00	40.00	32.00	16.00	
Cumaceans	2			50.00	50.00		
TOTAL	104						

Appendix IV cont.

Treatment- Pres.
Station- 2B
Sub-Sample- II

TABLE 8

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Cumaceans	6		33.33	16.67	50.00		
Heteromastus filiformis	39	48.72		51.28			
Streblospio benedicti	192	1.56	15.63	59.90	20.31	2.08	0.52
Eteone lighti	21	9.52		33.33	38.10	19.05	
Pseudopolydora kempi							
Polydora ligni	1	100.00					
Chaetozone sp.							
Exogone lourei	1		100.00				
Capitella capitata	2		50.00	50.00			
Gemma gemma	16	100.00					
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	21	4.76	19.05	71.43	4.76		
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	25		4.0	20.00	44.00	32.00	
Ostracods	14		21.43	42.86	35.71		
TOTAL	338						

H-201

H-202

Treatment- Pres.
Station- 2B
Sub-Sample-III

Appendix IV cont.

TABLE 9

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Cumaceans	1			100.00			
Ostracods	16		25.00	50.00	18.75	16.25	
Heteromastus filiformis	7	85.71	14.29				
Streblospio benedicti	177	6.78	10.17	53.11	16.38	12.99	0.565
Eteone lighti	17	17.65	23.53	11.76	23.53	17.65	5.88
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.	1					100.00	
Exogone lourei							
Capitella capitata							
Gemma gemma	8	62.50		25.00	12.50		
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	14	21.43	71.43		7.14		
Corophium ascherusicum	2		100.00				
Sarsiella spp.							
OLIGOCHAETEA	35		28.57	28.57	22.86	11.43	8.57
Glycinde polygnatha	3	100.00					
TOTAL . . .	281						

Treatment-Pres.
Station- 2C
Sub-Sample-I

Appendix IV cont.

TABLE 10

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	42		28.57	40.76	21.43	7.14	
Heteromastus filiformis	17	58.82	41.18				
Streblospio benedicti	335	3.58	5.67	51.94	19.10	18.21	1.49
Eteone lighti	16		25.00	37.50	12.50	25.00	
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	48	50.00	16.67	33.33			
Lyonsia californica	3	33.33	66.67				
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	28	32.14	28.57	39.29			
Corophium ascherusicum	2			100.00			
Sarsiella spp.							
OLIGOCHAETEA	10		60.00	20.00		30.00	
Cumaceans	5			100.00			
TOTAL	506						

Treatment-Pres.
Station-2C
Sub-Sample-II

Appendix IV cont.

TABLE 11

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	18		38.89	38.89	22.22		
Heteromastus filiformis	3	33.33	66.67				
Streblospio benedicti	348	4.60	12.07	53.45	25.29	4.60	
Eteone lighti	11	9.09	18.18	36.36	36.36		
Pseudopolydora kempi							
Polydora ligni	4	50.00	50.00				
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	33	66.67	3.03	30.03			
Lyonsia californica	3	66.67	33.33				
Musculus senhousia	1	100.00					
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	19	5.26	15.79	78.95			
Corophium ascherusicum	1			100.00			
Sarsiella spp.							
OLIGOCHAETEA	23		17.39	43.48	39.13		
Cumaceans	4			100.00			
TOTAL	468						

Treatment-Pres.
Station- 2C
Sub-Sample-III

Appendix IV cont.

TABLE 12

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis	20	100.00					
Streblospio benedicti	172	8.72	18.02	45.35	19.77	5.81	2.33
Eteone lighti	15	13.33		20.00	53.33	13.33	
Pseudopolydora kempi							
Polydora ligni	1		100.00				
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	7	85.71		14.86			
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	5	20.00	60.00	20.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	12			50.00	33.33	16.67	
TOTAL	232						

H 203

H - 204

Treatment-Not Pres.
Station-1B
Sub-Sample- I

Appendix IV cont.

TABLE 13

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Heteromastus filiformis							
Streblospio benedicti	22	4.55	13.64	63.64	9.09	4.55	4.55
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	1		100.00				
Corophium ascherusicum	1		100.00				
Sarsiella spp.							
OLIGOCHAETEA	19		5.26	31.58	21.05	21.05	21.05
TOTAL	43						

Treatment-Not Pres.
Station- 1B
Sub-Sample-II

Appendix IV cont.

TABLE 14

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	7			57.14	42.86		
Heteromastus filiformis							
Streblospio benedicti	23	4.35	26.09	60.87	8.70		
Eteone lighti							
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	4	25.00		75.00			
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	71			14.08	71.83	8.45	5.63
TOTAL	106						

Appendix IV cont.

Treatment-Not Pres.
Station-1B
Sub-Sample-III

TABLE 15

SPECIES RETENTION

		PERCENT NUMBER PER SIEVE OPENINGS (mm)					
SPECIS	TOTAL NUMBER	1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	8			100.00			
Heteromastus filiformis							
Streblospio benedicti	20		5.00	80.00	10.00	5.00	
Eteone lighti	2		50.00				50.00
Pseudopolydora kempi							
Polydora ligni							
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma							
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	1	100.00					
Macoma balthica							
Tapes japonica							
Ampelisca milleri	11		100.00				
Corophium ascherusicum							
Sarsiella spp.							
OLIGOCHAETEA	24			41.67	41.67	8.33	8.33
TOTAL	66						

Appendix IV cont.

Treatment-Not Pres.
Station-2A
Sub-Sample- I

TABLE 16

SPECIES RETENTION

		PERCENT NUMBER PER SIEVE OPENINGS (mm)					
SPECIS	TOTAL NUMBER	1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	4		25.00	75.00			
Heteromastus filiformis	1			100.00			
Streblospio benedicti	113	1.77		56.64	15.04	22.12	4.42
Eteone lighti	8			37.50	12.50	37.50	
Pseudopolydora kempi							
Polydora ligni	1			100.00			
Chaetozone sp.							
Exogone lourei							
Capitella capitata	2				100.00		
Gemma gemma	19	68.42	5.26	26.32			
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	9		33.33	66.67			
Corophium ascherusicum	5		20.00	80.00			
Sarsiella spp.							
OLIGOCHAETEA	18				22.22	61.11	16.67
Cumacean	3			100.00			
TOTAL	183						

H-205

H-206

Treatment-Not Pres.
Station-2A
Sub-Sample-II

Appendix IV cont.

TABLE 17

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	1		100.00				
Heteromastus filiformis	5	100.00					
Streblospio benedicti	141	7.09	7.09	56 74	14.89	21.99	4.96
Eteone lighti	4			25.00	75.00		
Pseudopolydora kempi							
Polydora ligni	7	85.71	14.29				
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	18	88.89	11.11				
Lyonsia californica							
Musculus senhousia							
Macoma inquinata							
Macoma balthica							
Tapes japonica							
Ampelisca milleri	13	7.69	46.15	53.85			
Corophium ascherusicum	1			100.00			
Sarsiella spp.							
OLIGOCHAETEA	13		15.38		30.77	30.76	23.08
TOTAL	203						

Treatment-Not Pres.
Station-2C
Sub-Sample-I

Appendix IV cont.

TABLE 18

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	15			60.00	40.00		
Heteromastus filiformis	10	60.00	10.00				
Streblospio benedicti	41	12.20	2.44	48.88	21.95	7.32	7.32
Eteone lighti	7				57.14	14.29	28.57
Pseudopolydora kempi	1		100.00				
Polydora ligni	1	100.00					
Chaetozone sp.							
Exogone lourei							
Capitella capitata							
Gemma gemma	7			100.00			
Lyonsia californica	3	66.67	33.33				
Musculus senhousia							
Macoma inquinata							
Macoma balthica	1	100.00					
Tapes japonica							
Ampelisca milleri	23	34.78	26.09	30.43	8.70		
Corophium ascherusicum							
Sersiella spp.							
OLIGOCHAETEA	4			25.00			75.00
Cumacean	2			100.00			
TOTAL	112						

Treatment-Not Pres.
Station-2C
Sub-Sample-II

Appendix IV cont.

TABLE 19

SPECIES RETENTION

SPECIS	TOTAL NUMBER	PERCENT NUMBER PER SIEVE OPENINGS (mm) 1.000	0.787	0.500	0.295	0.249	0.180
Ostracods	5			100.00			
Heteromastus filiformis	20	60.00	40.00				
Streblospio benedicti	41		2.44	19.51	39.02	24.39	14.63
Eteone lighti	10				70.00	10.00	20.00
Pseudopolydora kempi	1		100.00				
Polydora ligni							
Chaetozone sp.							
Exogone lourei	4						100.00
Capitella capitata							
Gemma gemma	21	71.43		28.57			
Lyonsia californica							
Musculus senhousia							
Macoma inquinata	3	66.67	33.33				
Macoma balthica							
Tapes japonica	1	100.00					
Ampelisca milleri	10	40.00	10.00	50.00			
Corophium ascherusicum	2		50.00	50.00			
Sarsiella spp.							
OLIGOCHAETEA	7				57.14		42.86
TOTAL	125						

Appendix V

Length-Frequency Diagrams

Figs. 1 through 10

H-207

H 207

Fig. 1

Gemma gemma - Sta. 5

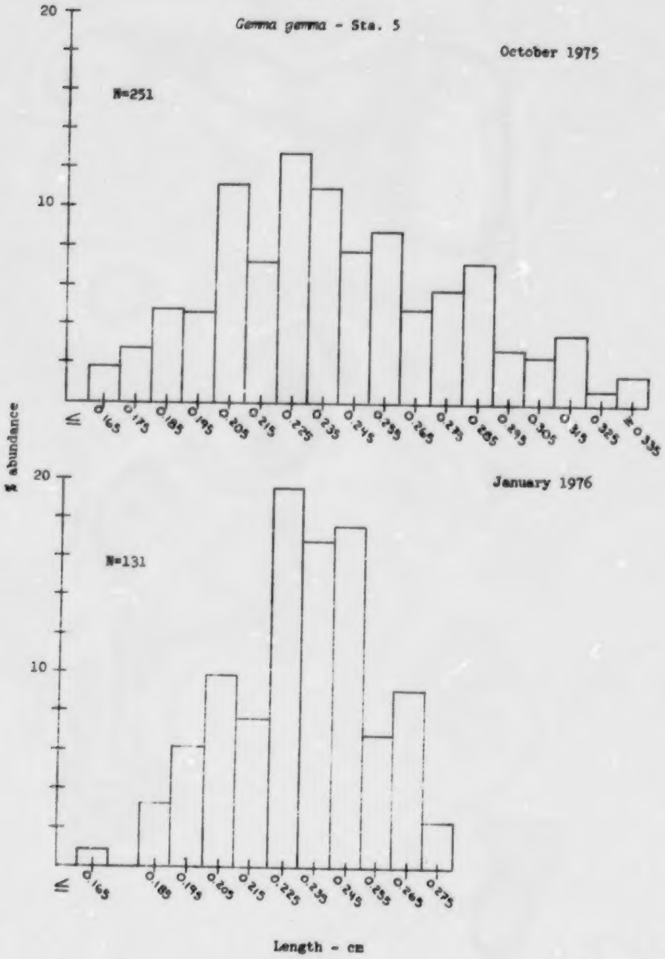
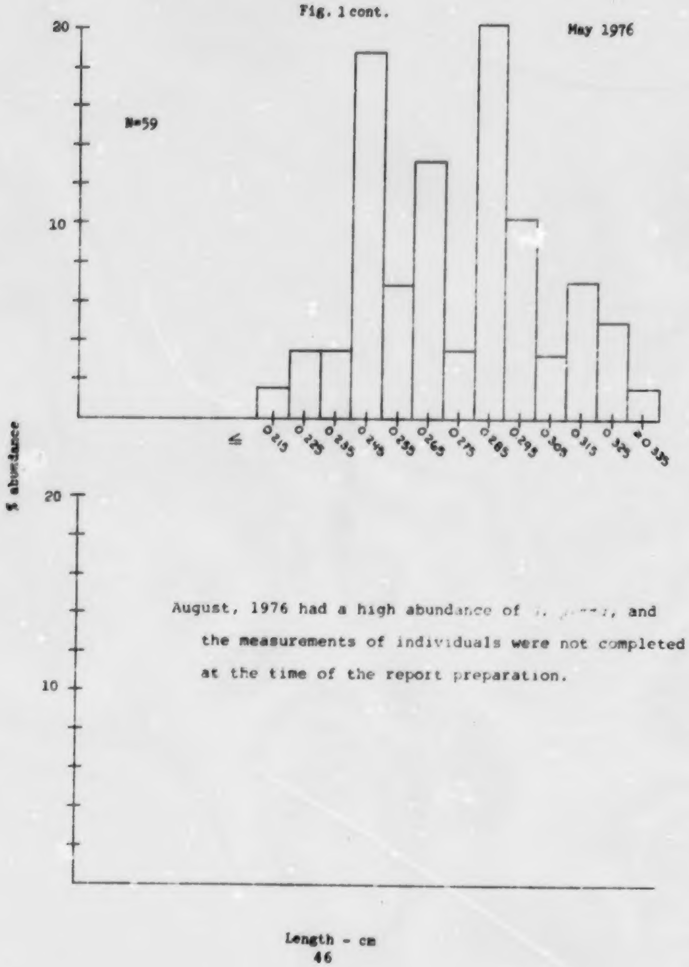


Fig. 1 cont.



August, 1976 had a high abundance of *G. gemma*, and the measurements of individuals were not completed at the time of the report preparation.

Fig. 2

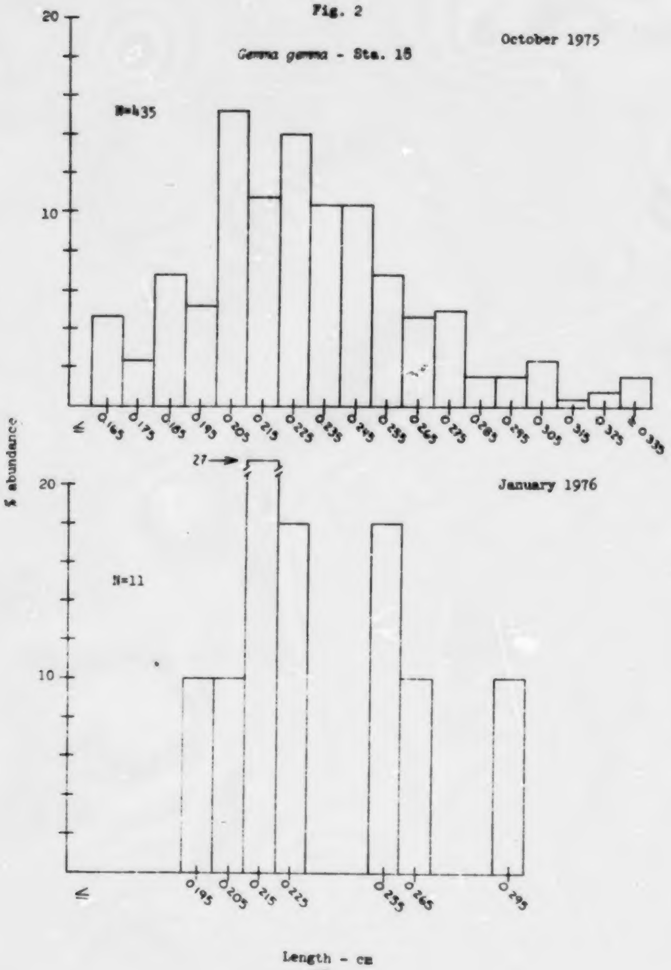
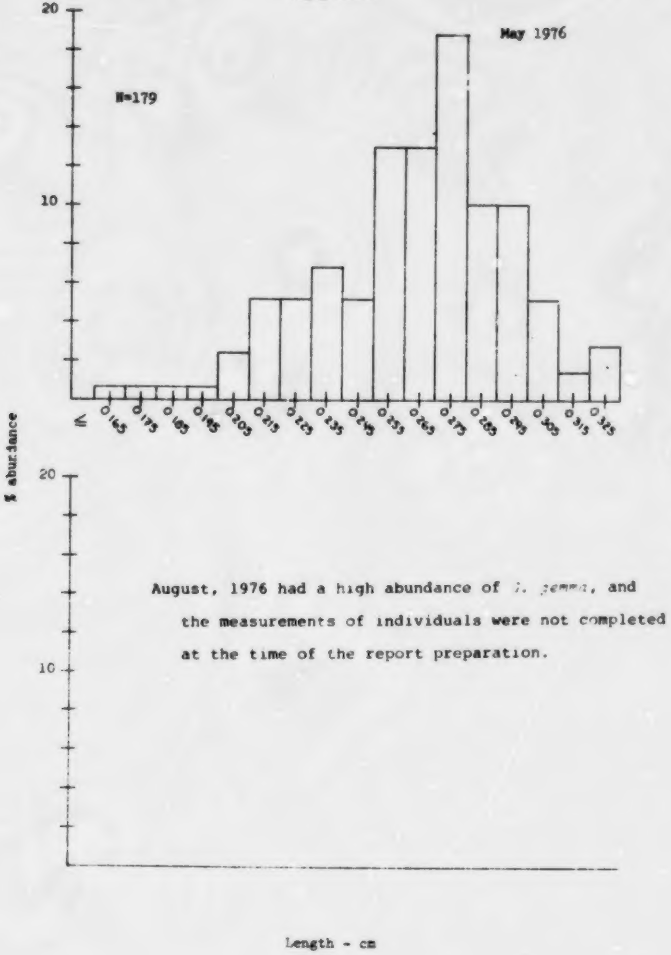
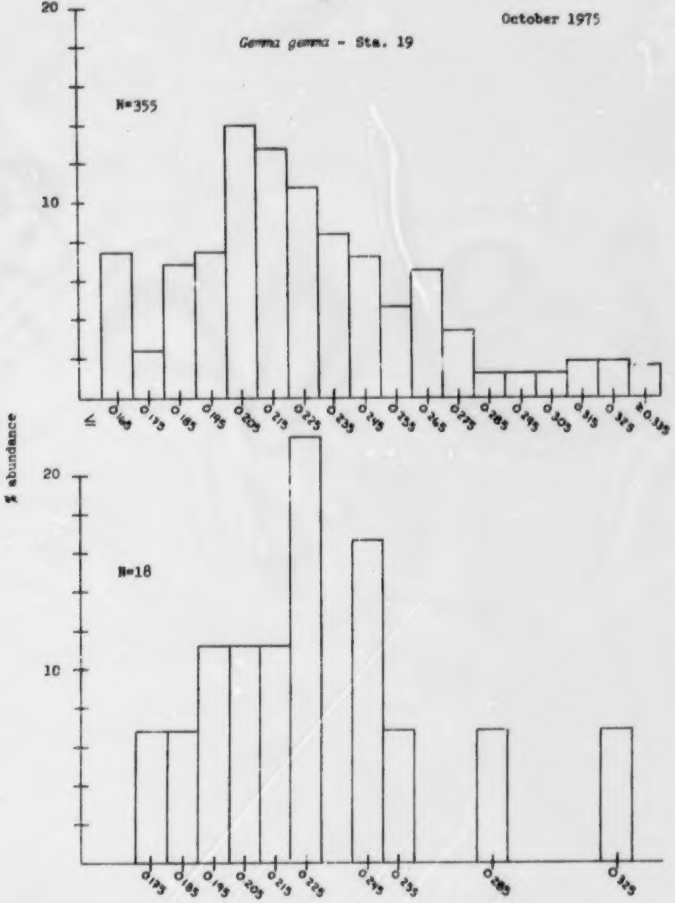


Fig.2 cont.



August, 1976 had a high abundance of *G. gemma*, and the measurements of individuals were not completed at the time of the report preparation.

Fig. 3

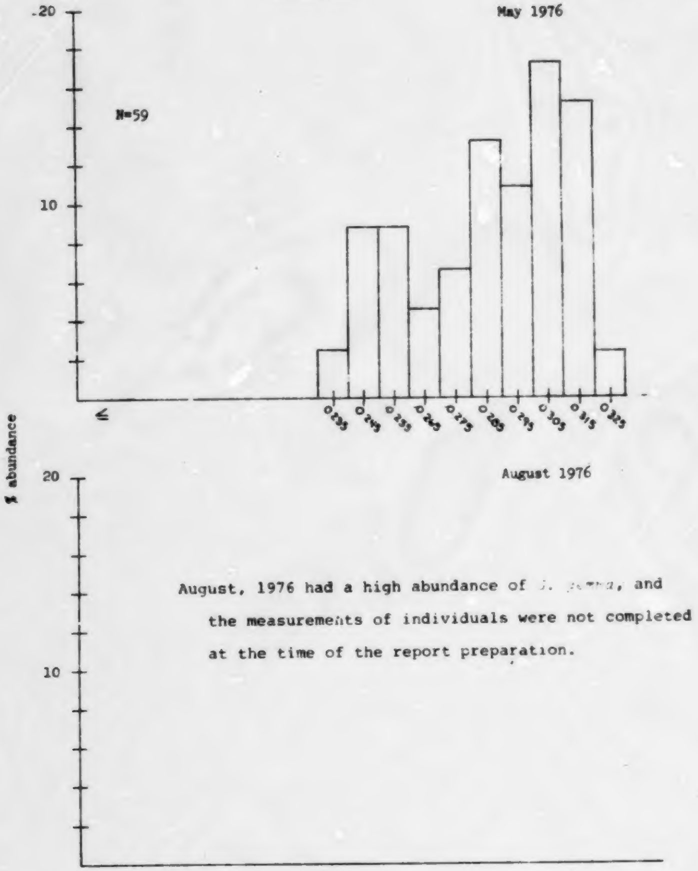


Gemma gemma - Sta. 19

October 1975

Length - cm

Fig.3 cont.



May 1976

August 1976

August, 1976 had a high abundance of *G. gemma*, and the measurements of individuals were not completed at the time of the report preparation.

Length - cm

Fig. 4

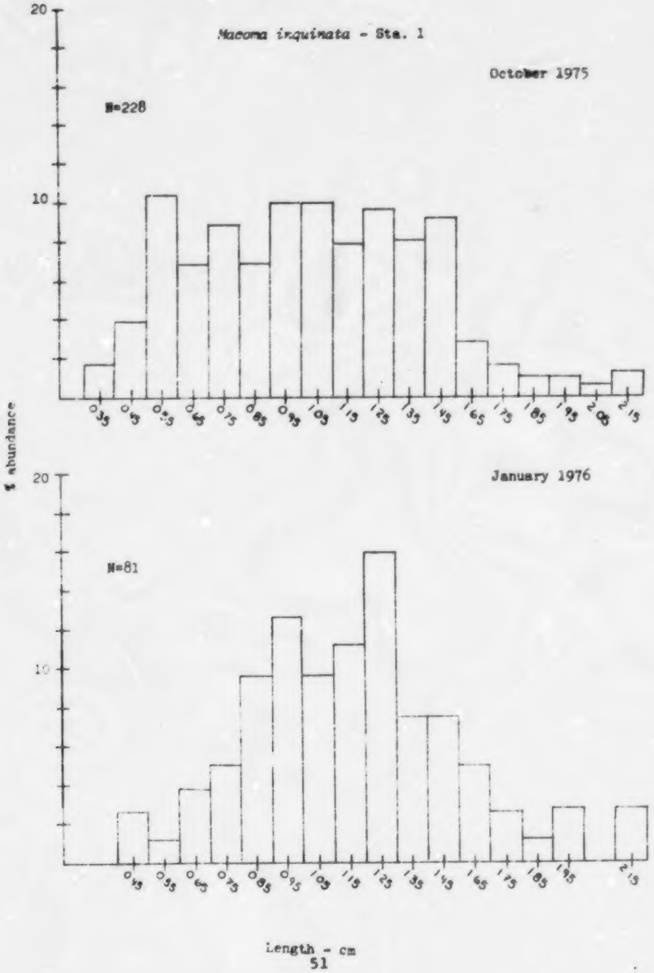


Fig. 4 cont.

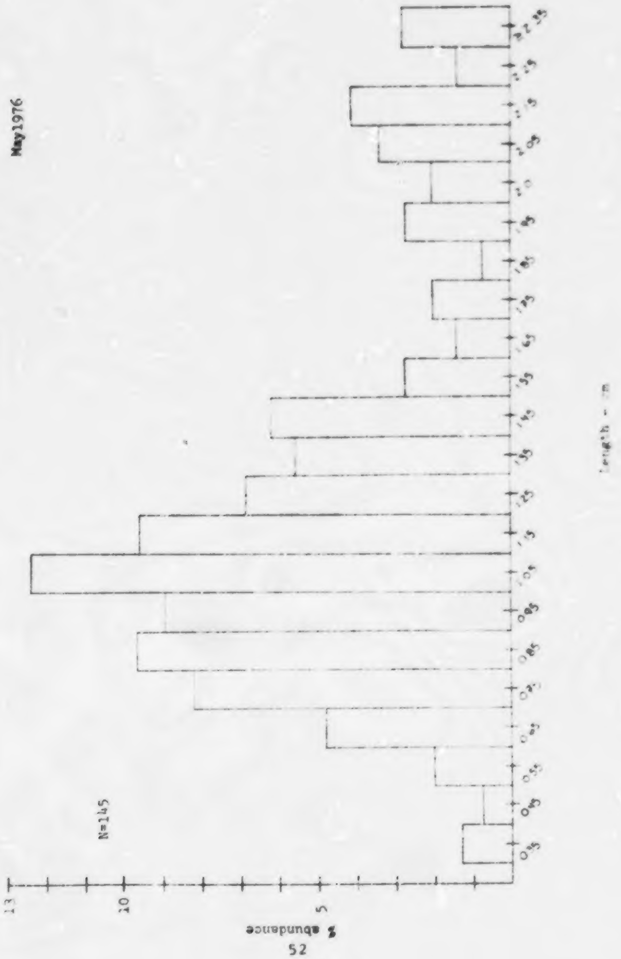


Fig. 4 cont.

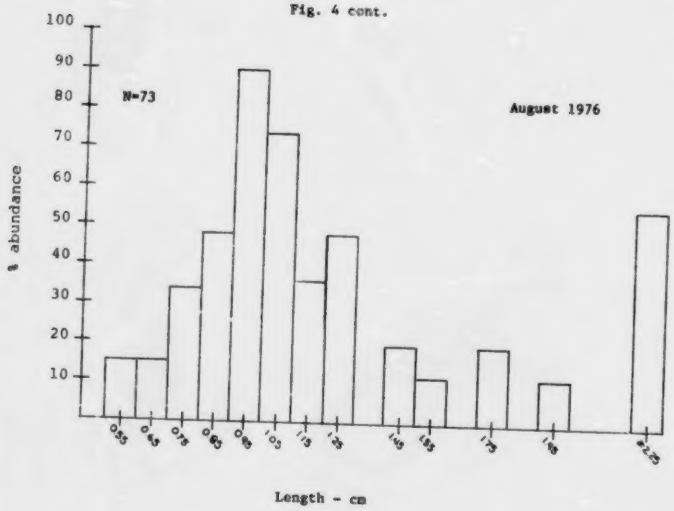
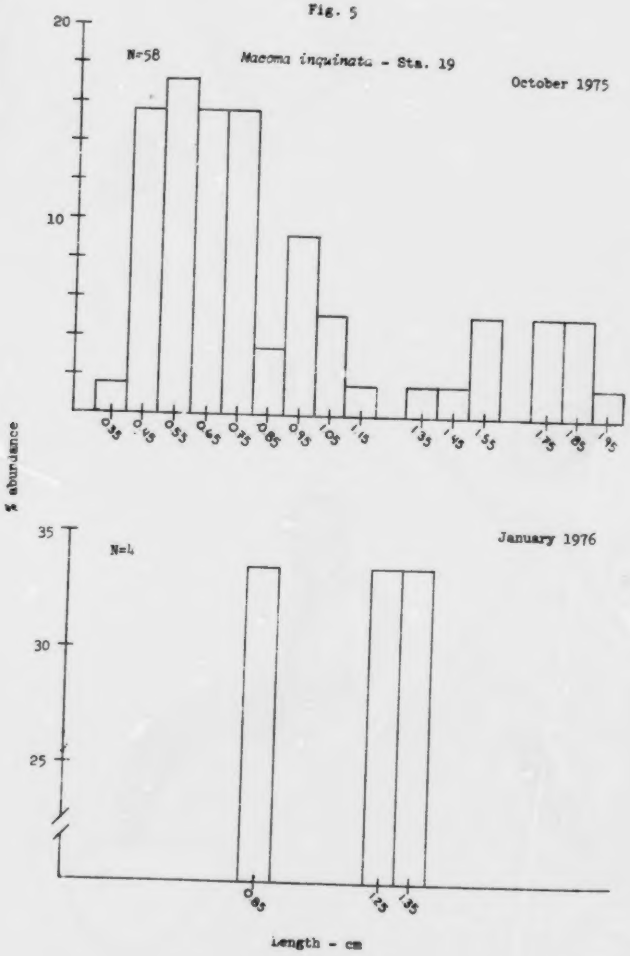


Fig. 5



H-212

Fig. 5 cont.

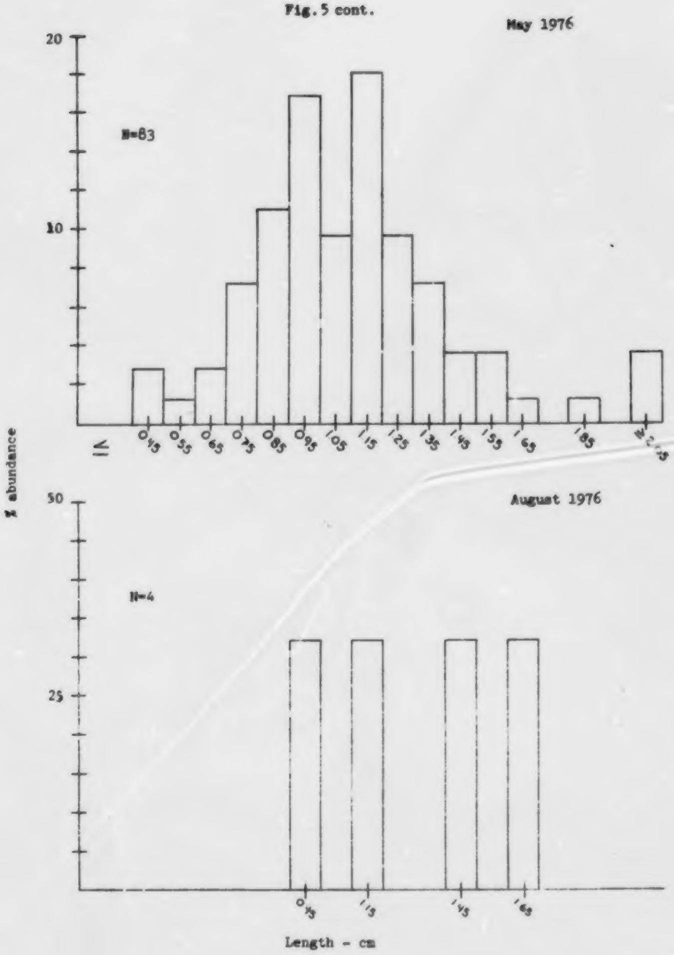


Fig. 6

Musculus senhousia - Sta. 12

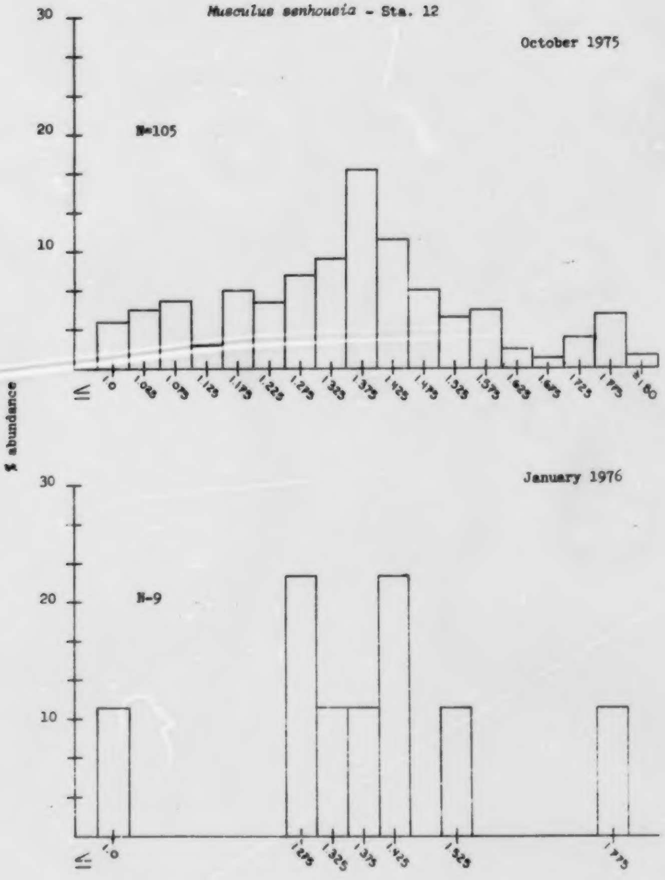


Fig. 6 cont.

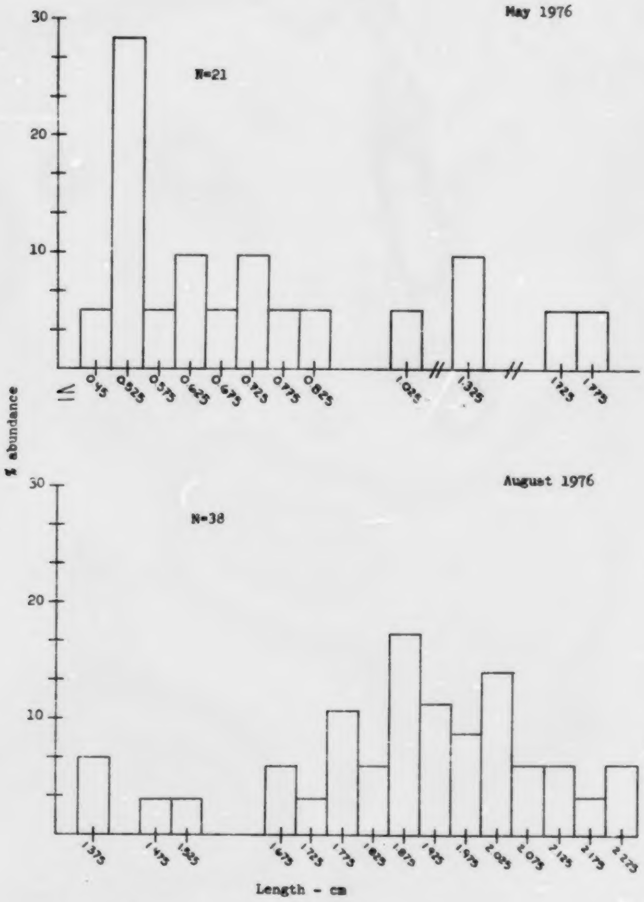


Fig. 7

Musculus senhousia - Sta. 13

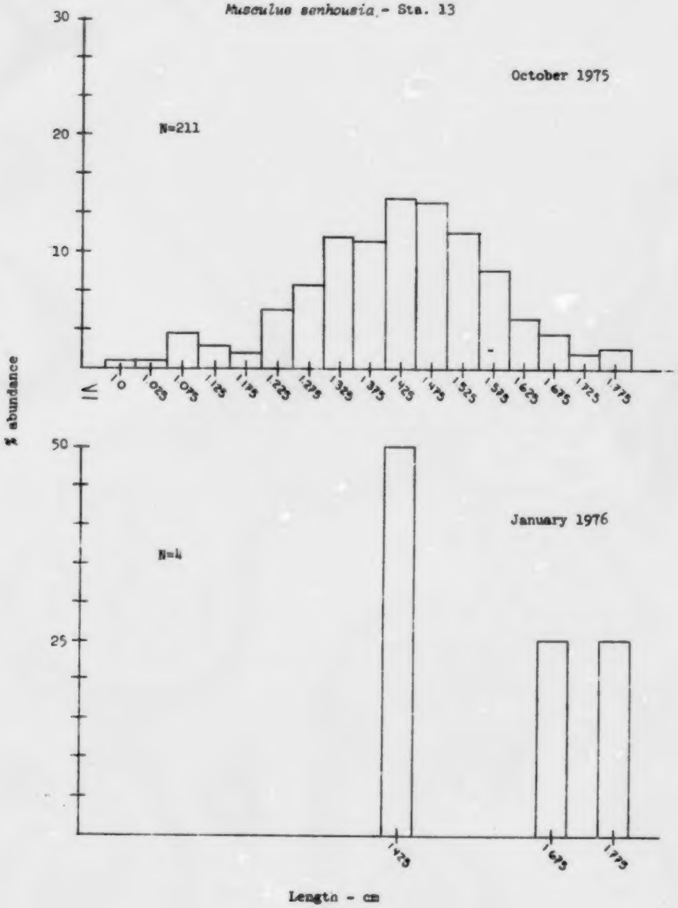
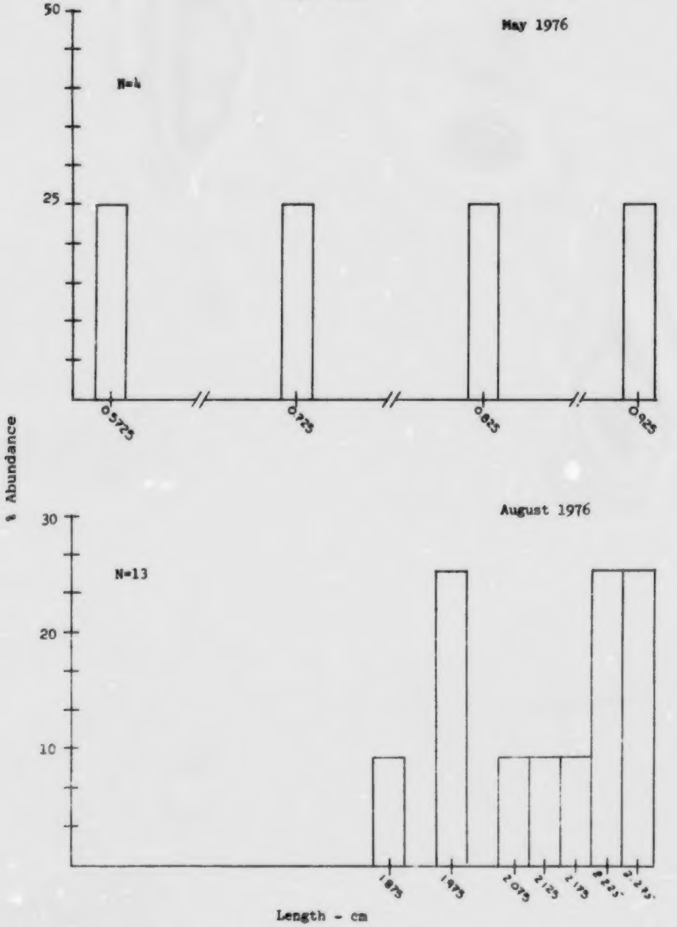
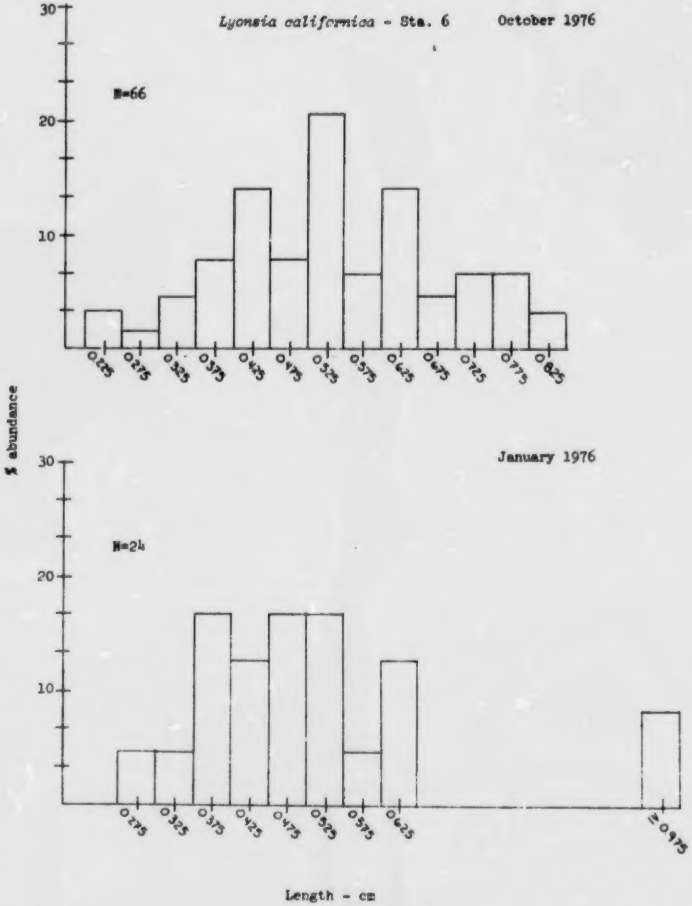


Fig.7 cont.


May 1976

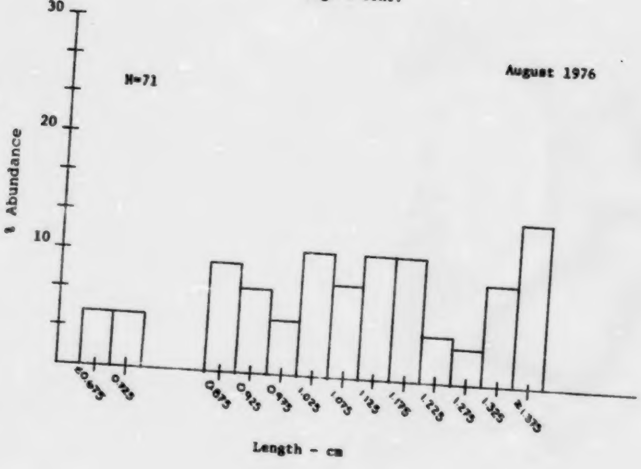
August 1976

Fig. 8


Lyonsia californica - Sta. 6 October 1976

January 1976

Fig. 8 cont.



Lyonsia californica was not present at this station in May, 1976.

Fig. 9

Lyonsia californica - Sta. 18

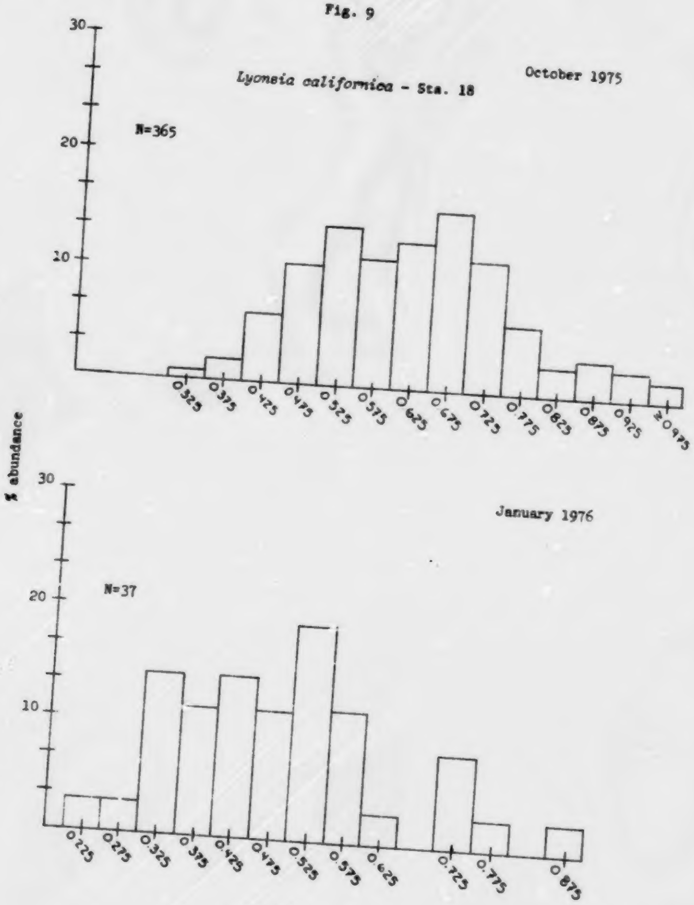
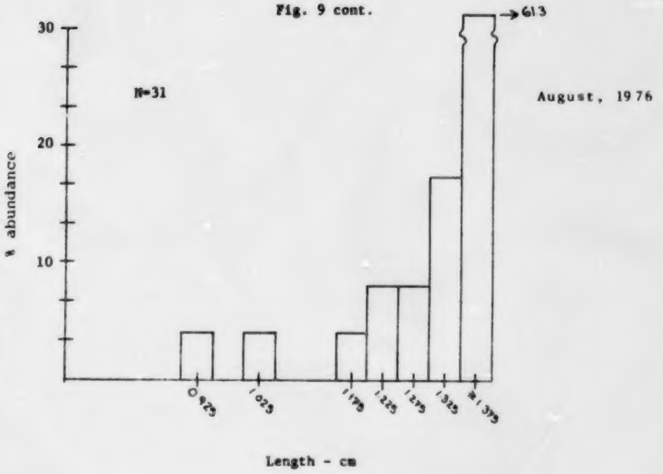


Fig. 9 cont.



In May, 19 only 2 individuals were collected, therefore size-frequency measurements were not made.

Fig. 10

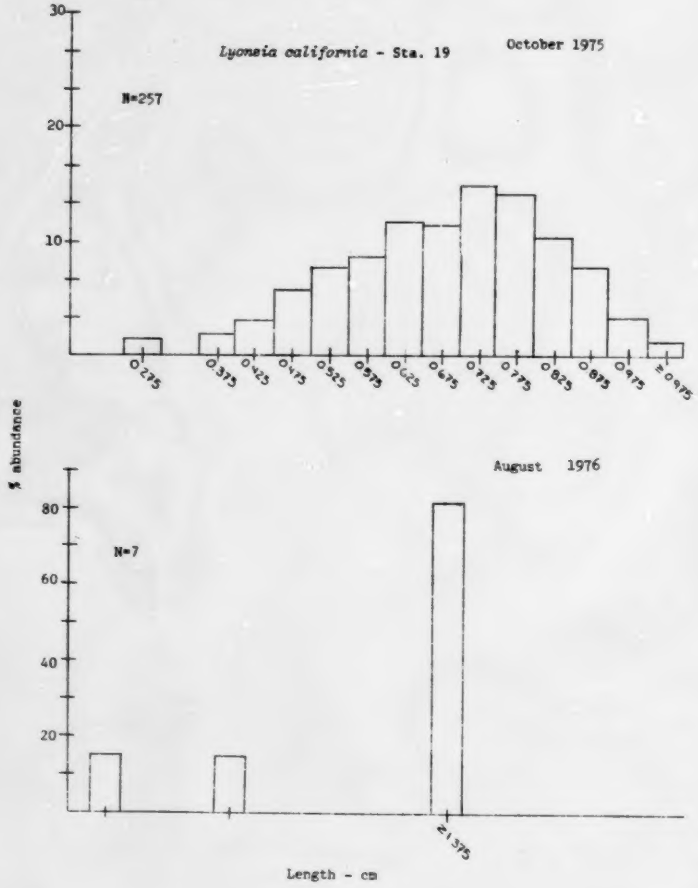
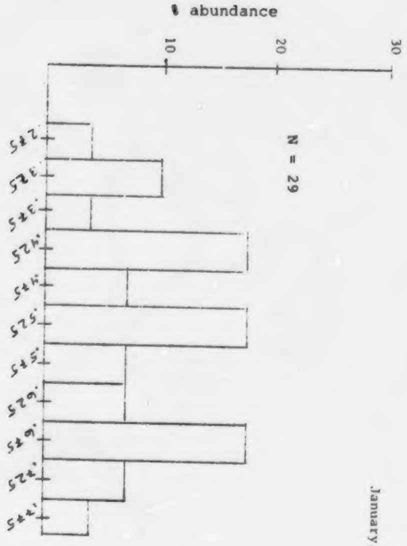


Fig. 10 cont.

January, 1976



Lyonsia californica was not present at this station in May, 1976.

Appendix VI

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Heteromastus filiformis* **South San Francisco Bay**

	Station													
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A		4	2	1	1			2	2	1	26	25	27	2	43
B		3	10			2	1			6	30	47	39	18	27
C		6				2	5	9	5	7	5	52	53	19	18
D		5	1				11	2	5	2	37	30	38		22
January, 1976															
A		5	18		10	4	4	3	5	9	3	9	14	21	3
B		1	26		17	1	6	2	1	9	11	10	8	15	1
C		7	21		7	2	3	5	3	6	6	6	15	19	3
D		6	12	1	11	3	2	6	1	11	13	10	8	21	36
May, 1976															
A			10	1	5		69	2	2	38	64	34	3	16	49
B			11		17	5	30	2	1	12	16	36	41	27	30
C		3	16		7	2	44		1	42	103	42	4	24	34
D		3	4		25	2	12	4	2	26	24	29	3	18	43
August, 1976															
A		4	4	2	7	1	13	14	2	18	28	47	50	21	31
B	1	4	20		13		21	9	4	17	38	24	26	1	47
C	1	17	18	5	15	1	8	25		22	36	19	15		15
D		17	20				13	12	2	3	32	70	137	16	21

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Streblospio benedicti* **South San Francisco Bay**

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A	32		1		5						110	4			3
B	11		1		2						15	8	2		1
C		3										9			
D											36	2	2		12
January, 1976															
A	51	6	4			10	3	292	8	1	6	1	36	10	
B	26	11	3	1		13	16	161	3		11	3	31		5
C	21	2	2		4	15	14	94	2	9	6	5	25	8	
D	22	9	5	4	3	11	2	168	1		13	3	17	2	12
May, 1976															
A	265	4	11	1	1	15	49	4	5	5	57	38	3	1	2
B	193	1	9	2	31	60	17	7	4	1	102	12	173	6	8
C	208	4	7		42	17	24	2	9	28	202	36	10	9	35
D	221	5		2	9	95	2	14	5	12	20	9	33		121
August, 1976															
A		3	2					3				1		6	
B	71	2						2				1			
C	31	3	16												
D	18	9										3	1		2

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Asychis elongata* **South San Francisco Bay**

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A					5	8				13	10	2	2		5
B					9	6	2			1	15	1	4		5
C				4		6			1	4			7		6
D						4	3		3	5	10	2	3		
January, 1976															
A				2	25	1		1	6	13	34	18			
B	1				22	5			9	17	23	11			
C				1	17		1	2	12	15	46	29			
D				1	11	4	4		5	11	35	26			
May, 1976															
A		1		3		3		2	12	3	1				
B				8	8	2			3	2		1			
C				6	6	1			3	7		1			
D		1		2	20	3			6	9	1				
August, 1976															
A				7	9	15	7		24	18	3	1	3		1
B				[illegible]	7		2		6	2		30	5		
C				12	3	6	1		10	1			13	2	
D				7	8		7		15	6		1	3		

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Glycinde polygnatha* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A				3	1	4		4		1					3
B	4					2		2		6	3				1
C						4		2		7					3
D				1		2	2	2		2					2
January, 1976															
A				5	1	3		3	3			1	2		
B				2	1	3	3	1	3	3		2			
C				1	3	3			1	2	1	1			
D				1	1	5	1		2	2	3	1			
May, 1976															
A			2		3		2			2	1				
B				2	2		2		1	2					1
C			1	1	2		1			2	2				
D			3		4			1							
August, 1976															
A		1		1	1			1			1	3	1		1
B					8		2	2	1	2	2	3	1		1
C			3	1	2		5	1			2			1	1
D		1	2				1	3	1	1	4	1	1		3

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Eteone lighti* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A	1		3								2		1		1
B	5										3	3	3	1	
C		1										4	4		
D					3			1				3	6		1
January, 1976															
A	8	18	17							1	1	1	9	9	
B	1	10	17							1		2	11	6	
C		16	17							1		2	13	5	
D		25	14					2			1	1	12	10	10
May, 1976															
A	3	2	7							2	5				8
B	5	1	3								6	2	19	2	4
C	6	4	2							2	18	2		1	9
D	2	6	11		1						11	1	1		15
August, 1976															
A	18	3	2								1	1			
B	15	2					1			1	1	1	1		
C	12	5	1					1			2	1			1
D	13	6	12								1	4			

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Nephtys caecoides* **South San Francisco Bay**

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A						1		4							
B						1									
C						2									
D						1	1	1							
January, 1976															
A										1	1				
B								4			1		1		
C							3	3	2						
D							2	1		1					1
May, 1976															
A						1			2						
B				1		1			1						
C						4		1							
D				1		2									
August, 1976															
A						2	2	3	2		1		1		
B					2		3	8		1		1			
C				1		6	1	10	1		3	1			1
D				1	2			5	2						

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Neanthes succinea* **South San Francisco Bay**

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A	3	2	3		1										2
B	6		3											4	2
C		2			7									2	
D	8	1	1											3	1
January, 1976															
A			1											1	
B										1				2	
C														1	
D			1											1	
May, 1976															
A														1	
B		1												1	1
C		2												1	
D														3	
August, 1976															
A	2	1	1								1	1		2	3
B	1	3	1								1			5	3
C	1	5	1								2	1		5	2
D	1	2													2

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Marphysia sanguinea* South San Francisco Bay

Replicate	Station 1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A				2	5					1					3
B				6	2						1				2
C										3	2				3
D				2						2					3
January, 1976															
A				5	1							1			
B				3	1					2					
C				4	1					2					
D				2	3										
May, 1976															
A					1					2					
B							1			2					
C				2						2					
D				2											
August, 1976															
A									1	1					
B															
C											1				
D					1										1

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Eteone californica* South San Francisco Bay

Replicate	Station 1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A							7				6	4			1
B							1				5	2	9		2
C							9			1	2	2			1
D										1	3				1
August, 1976															
A		1	1												
B															
C		1	3												
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Amaeana occidentalis* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A				2											
B															
C													1		
D														1	
January, 1976															
A				2	24										
B				1	33										
C					13										
D				1	9										
May, 1976															
A															
B					1					1					
C															
D					1										
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Pseudopolydora kempi* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A											5				
B											5	3	2		1
C									1	2		40			
D										1	4	1	2		
January, 1976															
A										5		2	13		
B						1	3	1		2		1	7		1
C			1			1	6		1	5		1	2		
D						3	2	1		6		2	7		
May, 1976															
A							3			1		12			
B			3					1			2	20	6		
C			1		1		1	1				27			1
D												17			2
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Polydora ligni*

South San Francisco Bay

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A	6														
B	12														
C															
D															
January, 1976															
A															
B					1	2							1		
C													3		
D	1	1			1								2		
May, 1976															
A	1		5				11	1			5	32		1	4
B	1		4		8		2				2	16	8		6
C	1		4				1			2	10	38		1	8
D		2	4		2		3	1		3	3	19		3	13
August, 1976															
A	1	1										3	1	1	
B	17		2								1	2			
C	2			1								1	1		1
D	1														

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Chaetozone* **sp.**

South San Francisco Bay

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A											1				2
B												2	2		
C															1
D												1	3		1
January, 1976															
A								5					5		
B													8		
C													6	1	
D						1							4		
May, 1976															
A							1					1	1		2
B							1				2	1		4	1
C										3		8	4	1	1
D			1							1	1		14		2
August, 1976															
A			1												
B					1										
C			2												
D			2												

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Harmothoe imbricata* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D				2											
January, 1976															
A															
B															
C															
D															
May, 1976															
A															2
B							1							1	
C															
D															
August, 1976															
A														4	
B										1	2				1
C							1			1				1	
D							1							1	1

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Exogone lourei* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A				1											
B															
C															
D															
January, 1976															
A						2			1						
B						10									
C						1	1								
D						5	1								
May, 1976															
A				1			10		1						
B					3	2	4			1			1		
C				3		3	10		5	6					
D						11	3		4	3					3
August, 1976															
A															
B															
C															
D													1		

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Capitella capitata* **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A						1									
B															
C															
D											2				
January, 1976															
A													2		
B				1											
C													3		
D													1		
May, 1976															
A			2	1	5		4			1		12	1		1
B												6	4		
C			3				5			3	3	17	3		3
D			1		2		2			3	1	10	1		17
August, 1976															
A													1		
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Scolelepis squamatus* **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A									1						
B															
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A												1			
B							1								
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Haploscoloplos elongata* **South San Francisco Bay**

Replicate	Station 1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A										1					
B							1			2					
C										1					
D															
August, 1976															
A															
B										1		1			
C				1	1					1					
D										1					

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Gemma gemma* **South San Francisco Bay**

Replicate	Station 1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A		51	8		1	13	3		13	2	109	101	12	17	10
B		89	21			5		10	15		210	160	9	80	17
C		81			25	14	16	1	9	1	94	66	8	2	
D		46	45			15		1	12		109	102	10	21	7
January, 1976															
A	1	18	22					18	4		6	4	36	34	
B		45	22			1		3			2	3	33	19	2
C		25	18			1						5	18	42	
D		53	29			2		46			3	5	14	58	4
May, 1976															
A		19	31			2	18				97	23		23	5
B		7	29			4					25	10	1	24	4
C		19	18				5				22	11		13	21
D		15	36			20	4				43	2	110	10	2
August, 1976															
A	1	532	144		1	22	3	120			977	33		162	249
B	1	239	389		3	8	4			2	695	223		10	43
C	23	232	474		4	54	1	144		1	266	213	1	22	138
D		295	552				2	88			46	710		68	165

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Lyonsia californica* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A	1	102	37					7			149	98	3	14	15
B		96	29			2		7			158	77	2	48	20
C		60			8	2		2			14	65	1	1	1
D		57	40			1	53	12			106	74	5	33	3
January, 1976															
A		3	7			9	3	29	47		16	5		48	
B		8	5		3	6	4	8	15		9	2	3	16	2
C		2	12		6	9	3	3	11		1	12	1	36	
D		8	4		1	11	4	34	12		12	10		30	3
May, 1976															
A						1			8		1			9	1
B		1				1	1	2	4				1	9	
C						2		1	3					9	1
D	1				1	6		1	2	1	1		1	7	
August, 1976															
A		29	13			1	17	1			11	4	12	3	27
B		6	23				14	1	1		17	2	13		34
C		11	8				4	2			4		4	3	28
D	1	8	24				7	7			4	1	21		38

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Musculus senhousia* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A		14	25		44	68	17	5	31	46	6			48	10
B		23	16	1	8	52	7	2	34	28	5		2	56	14
C		5		10		49	11	1	20	75					
D		3	34	2		16	25	1	21	75				84	5
January, 1976															
A		2			134		2				1	2	1	2	
B			4		112		82		2	3	1	1		9	
C			2		96	1	48	1	4	1	3	2	1	1	1
D			1		69		7		3		1	1		7	1
May, 1976															
A					64				11					12	1
B				2	85				3	1		1			1
C					42		2		2					3	5
D				3	77	1	1		5	1				27	
August, 1976															
A		6	5		9	5	9		4	5	1		2	3	5
B		5	6		50	5	3	1	15		2		7	3	4
C		4	8	5	18	5	3	2	12	7	5			64	3
D		5	7	68	35		7	2	6	2	2		5	12	4

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Macoma inquinata* **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A	55		5			1		2	3		7	19	15	3	
B	69	11	7					5	1		11	26	15	1	1
C	105				19			2	1		1	23	4		
D	43		3				1	2			10	22	15		3
January, 1976															
A	23	2	2		1			1					1	2	
B	12	6	9				2		1		2			-	
C	28	11	10		1	1	1				1		1	1	1
D	19	10	3		1			1	2		1	3		7	1
May, 1976															
A	13	6	6	1	1	3		1			3	13	12	4	2
B	18		5		3	1			1	1	1	25	8	1	
C	11	1	3									24	9	3	3
D	16	4	3	1	1	1	1			1	4	22	10	3	5
August, 1976															
A	20	3	1					2	1		5	1	3	3	2
B	17		1	1	1		1	2			2	3	1		1
C	17	1					1	1	3		1		3	2	
D	21	5	1	2	7			2	3			2	1	2	1

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Macoma balthica* **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A	8	2	2					1			1		4		
B	8	2	2										1		
C	9	1			6							2	2		
D	4	1	1					1	2		3		4		
January, 1976															
A	2														
B	2		1												
C	6	1													
D	6	1											1		1
May, 1976															
A	1										1				
B															
C											4				
D															
August, 1976															
A		2									1				1
B	3											1			
C	1												1		
D	1														

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Macoma nasuta* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A					2				1						
B							1	1				1			
C					1			3	1					1	
D				1	1		1	1							1
May, 1976															
A				1	2			1							
B					1		1	1				1			
C				1	4			4	1			1			
D					3		1	5							
August, 1976															
A					2										
B					4	2	2		1				1		
C						1									
D					1			1							

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Tapes japonica* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A					2	1									
B			1	3					2					1	
C									1						
D				2											
January, 1976															
A				1	1	1					2			1	
B				1	2	1	1								
C					2										
D			1	1	8							1		1	
May, 1976															
A					1										
B				1	5	1									
C								1							
D			1		4					1					
August, 1976															
A					1	4			1				1		
B					6	1			1						
C			1		3	2		4	3			1			
D									1				2		

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Urosalpinx cinerea* South San Francisco Bay

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A															
B															
C							1								
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Ostrea lurida* South San Francisco Bay

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A															
B															
C															
D				1											

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Nassarius obsoletus* **South San Francisco Bay**

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A															
B															
C															
D															
January, 1976															
A		1				2					10				
B						3					8	1			
C											3	2			
D	1					6				1	3	2	2		1
May, 1976															
A											2				
B			2			2			1						
C					2										
D															2
August, 1976															
A													1		
B												1			
C								1							
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Crepidula fornicata* **South San Francisco Bay**

	Station														
Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A															
B															1
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Ampelisca milleri* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A	115		5								31	12		65	65
B	65		7					9		1	42	15	3	100	52
C	1											5	13		6
D	2	35	3						1		30		10	14	25
January, 1976															
A	1	10	33		8	140	7	11	89	24	273	109	16	41	
B	1	19	34		5	116	93	7	54	22	154	92	19	44	149
C		9	63			157	29	7	76	51	64	239	12	23	29
D		15	22		2	200	28	18	37	20	184	169	12	26	281
May, 1976															
A	2	29	51	53			487	1	27	48	4	3		27	228
B			70	49	38	10	84	1	28	62	7	1		5	745
C	1	15	29	29	15		476		19	123	11			23	224
D		105	72	27	17	7	706	7	29	95	9	1	7	6	1234
August, 1976															
A	327	195	62	4	3		4	8	3		6		28	130	24
B	377	35	298		11		11	4		3	57	1	1	48	8
C	534	81	219			11	2	1	1	9	19			24	3
D	117	155	10		2			3	2	1	3	1	126	41	51

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Microdeutopus schmitti* **South San Francisco Bay**

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A											1				6
B															6
C															
D													1		2
January, 1976															
A		1				3					2	4	1		
B						5				2		2			
C		1	5			2						1			
D			1			6				1	1		2		1
May, 1976															
A														2	3
B															7
C										1				1	3
D		1					2			3				1	16
August, 1976															
A	128	22	17											3	
B	160	1	25		1			1		7	7			1	2
C	152	3	45			4	2	1		3	1			1	
D	67	2	5								3	1	5	1	6

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Corophium ascherusicum* **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A														1	5
B												3			6
C													1		
D															1
January, 1976															
A					1										
B															
C			2			2									
D			1												
May, 1976															
A				1						1				15	2
B								1		2					9
C														2	3
D		1					5			1					27
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Caridea **South San Francisco Bay**

Station

Replicate	**1**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**19**	**20**	**25**	**30**
October, 1975															
A															
B															
C		1													
D															
January, 1976															
A															
B															
C															
D				1					1						
May, 1976															
A									1					1	
B														2	
C				1											
D				1											
August, 1976															
A															
B															
C															
D											1				

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Balanus* sp. **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D			1												
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A															
B															
C															
D				X											

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Synidotea laticauda* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A											1				
B															
C						1									
D															
January, 1976															
A															
B					1										
C					1					1					
D					1									1	
May, 1976															
A															
B															
C															
D															
August, 1976															
A			2										1		
B														1	
C															
D											1				1

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Bryozoa — **South San Francisco Bay**

	Station														
Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A				X		X				X					
B				X											
C				X		X				X					
D				X		X			X						
May, 1976															
A															
B					X		X								
C						X									
D															
August, 1976															
A															
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Ciona intestinalis* — **South San Francisco Bay**

	Station														
Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A						63								3	5
B			1											3	2
C						16				1					
D						3								4	
January, 1976															
A					1										
B															
C					2										
D					2										
May, 1976															
A					1										
B															
C															
D															
August, 1976															
A			2	1										5	
B			3												
C		1	1											12	
D									1					3	

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Diadumene* sp. **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A				2										2	
B															1
C															
D				2											
January, 1976															
A															
B															
C										1					
D															
May, 1976															
A					6										
B															
C				1											
D								1							
August, 1976															
A			1												
B														2	1
C														1	
D									1						1

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Pyromaia tuberculata* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B															
C															
D															
August, 1976															
A															
B															
C															
D							1								

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Permanent Sampling Stations

1.0 Sieve Fraction

Species: *Leptocottus armatus* **South San Francisco Bay**

Station

Replicate	1	5	6	7	8	9	10	11	12	13	18	19	20	25	30
October, 1975															
A															
B															1
C															
D															
January, 1976															
A															
B															
C															
D															
May, 1976															
A															
B										1					
C															
D															
August, 1976															
A						1									
B															
C															
D															

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Heteromastus filiformis* **South San Francisco Bay**

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A			2	1				11	19	2	2	14	1	9	3
B						15		25	5	4		2	4	9	11
C		1		2				33	8	3	2	8	3	6	4
D				2			18	14	17		2	28	2	27	4

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Streblospio benedicti* **South San Francisco Bay**

Replicate	Station 2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A	15			17					4						
B	18			1				1				2			
C	26	1		7					4						
D	8				1		2	19	10			4			

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Asychis elongata* **South San Francisco Bay**

Replicate	Station 2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A					1	15		4						2	6
B						4								1	5
C								5						1	19
D	1					3									7

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Marphysa sanquinea* South San Francisco Bay

	Station														
Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A			1			2				13	3		10	5	
B		2	2			4		1		7	3		7	3	1
C										6	2		10	3	
D										9	3	1	6	6	

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Glycinde polygnatha* South San Francisco Bay

	Station														
Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A														1	4
B						1							5	2	
C				1									3		2
D													2	1	2

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Eteone lighti* **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A	3			1				3	2						
B	1	2	1		1				1			1			
C				4				2	1			4			
D	1							5	6			2			1

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Amaeana occidentalis* **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A										5	3		3	7	
B										22	7			6	
C										1	9			2	
D										3	10			4	

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Neanthes succinea* South San Francisco Bay

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A	1			1				1							
B															
C	2	7						3							
D	1	7			4		1								

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Pseudopolydora kempi* South San Francisco Bay

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A															
B												1			
C															
D									1						

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Polydora ligni* **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A									1						
B	3								1			1			
C	2								2						
D					1		1								

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Chaetozone* sp. **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A															
B									1						
C															
D							1								

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Nephtys caecoides* South San Francisco Bay

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A															1
B															1
C															
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Harmathoe imbricata* South San Francisco Bay

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A								1					1		
B													1		
C															
D													2		

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Exogone lourei* **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A													1		
B															
C															
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Gemma gemma* **South San Francisco Bay**

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A			14		18		37	80	16			17			
B	3	87	47		21		24	17	12			8			
C		54	49	1	13			195	15			7			
D		37	14		10		229	140	12			11		1	

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Lyonsia californica* **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A	1		6	1	3			15				6			
B		84	15					13				7		2	1
C		300	5	2			1	24	1			14		2	
D		246			15		2	16				3			1

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Musculus senhousia* **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A					1	13	9	24				18	1	12	85
B					1	13			1			31		4	47
C		8				24	8					52		4	74
D		6			1	19	30					21		7	61

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Macoma inquinata* South San Francisco Bay

	Station													
Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A	22		44	13	13	1		5	3			13			1
B	17	4	49	3	10			14	10			19			
C	14	46	39	19	15			10	6			15			1
D	23	26		6	30		2	6	7			12			

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Tapes japonica* South San Francisco Bay

	Station													
Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A						1									2
B						1								1	1
C												1		2	3
D						1									1

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Macoma nasuta* South San Francisco Bay

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A															1
B															1
C															
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Ostrea lurida* South San Francisco Bay

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A															
B															
C															
D													1		

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Crepidula fornicata* **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A							3								
B							2								
C															
D							5								

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Nassarius obsoletus* **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A															
B															
C									1						
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Ampelisca milleri* **South San Francisco Bay**

Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A	8		10						22			70			49
B			13						8		1	20			
C	3	40	3	44					44			65	1	18	65
D	1	17		6				40	42			37			61

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Microdeutopus schmitti* **South San Francisco Bay**

Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A	8							20							
B	9							10							
C	3							6				6			
D								9	2			5			

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Corophium acherusicum* **South San Francisco Bay**

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A												2			
B						1									
C								1				4	1	1	1
D								7	2			6			

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Synidotea laticauda* **South San Francisco Bay**

Station

Replicate	2	3	4	14	15	16	17	21	22	23	24	26	27	28	29
October, 1976															
A														1	
B		1						4							
C															
D												1			

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

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Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Pyromaia tuberculata* **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A															
B															
C							1								1
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Bryozoa **South San Francisco Bay**

	Station														
Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A													X		
B															
C											X				
D															

* The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.

X denotes the presence of a colony

Appendix VI cont .

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Diadumene* **sp.** **South San Francisco Bay**

Station

Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A															
B															
C															
D							1								

*** The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.**

Appendix VI cont.

Numbers per Ponar Grab (0.0504 m^2)

Preliminary Survey Stations *

1.0 Sieve Fraction

Species: *Ciona intestinalis* **South San Francisco Bay**

Station

Replicate	**2**	**3**	**4**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**26**	**27**	**28**	**29**
October, 1976															
A															
B												1			
C															2
D															

*** The preliminary survey included all 30 staions. Listed above are the stations that were not chosen for the permanent sampling stations.**

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Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 1 A 1	 A 2	 B 1	 B 2	 C 1	 C 2	 D 1	 D 2
Heteromastus filiformis								
Streblospio benedicti	296	280	200	128	256	288	840	544
Eteone lighti								
Eteone californica								
Pseudopolydora kempi	8	16		16				
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	200	208	312	184	184	80	16	8
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	24	16	40	80	96	96	72

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII cont.

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 2 A 1	 A 2	 B 1	 B 2	 C 1	 C 2	 D 1	 D 2
Heteromastus filiformis								
Streblospio benedicti	256	184	208	168	40	104	184	176
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	8							
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	40		16	32		8	24	8
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	224	272	352	376	136	88	320	352

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
	Station # 3							
Heteromastus filiformis								
Streblospio benedicti							64	64
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri							80	64
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta							232	328

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
	Station #4							
Heteromastus filiformis								
Streblospio benedicti	32	40	24	16	16	8		
Eteone lighti					24	8		
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	48	64	256	184	128	160		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	152	168	104	120	224	184		
Neanthes succinea	8	8						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 5 A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	24	40	8	24	200	160		
Eteone lighti		3			24	24		
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	104	64	88	168	240	200		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	200	216	80	88	232	192		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 6 A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	8						56	80
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	128	128					440	536
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.	16	8						
Oligochaeta	72	96					88	48
Gemma gemma	32	16						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station #7

Replicate **Sub-sample**	A		B		C		D	
	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	56	48	112	96	8	32	8	8
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	7		16					
Exogone lourei					32	40		
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	336	296	272	200		8	8	8
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	40	16	24	16	32	32		16
Gemma gemma		16						
Amaeana occidentalis	16							

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station #8

Replicate **Sub-sample**	A		B		C		D	
	1	2	1	2	1	2	1	2
Heteromastus filiformis		8						
Streblospio benedicti	24		16				40	15
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	32	24	24	8			184	232
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	72	80	48	24			88	36
Scolelepis squamatus	8							
Amaeana occidentalis		8						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	Station # 9 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	32	96	84	104	136	96	96	48
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	144	152	136	184	48	8	272	288
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	40	24	56	108	48	48	40	32
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	88	48	32	64	24	16	40	40
Neanthes succinea		8						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	Station # 10 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	16	16	8	8	8	8		
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei					8			
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	40	48	8	32	48	40		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	64	40	16	8	40	24		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station # 11

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	32	24	48	32	48	40	48	32
Eteone lighti	8							8
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei		8		8			8	8
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	200	128	128	104	112	136	152	128
Microdeutopus schmitti								
Corophium ascherusicum								
Sarsiella spp.	24	8	8		8	24	48	16
Oligochaeta	8	16	24	8	16	16	32	24

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station # 12

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis				24				
Streblospio benedicti	88	48	56	16	112	104	40	32
Eteone lighti			8					
Eteone californica					24		8	
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei		16			8		8	32
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	168	112	144	168	288	232	72	96
Microdeutopus schmitti								
Corophium ascherusi								
Sarsiella spp.	32	8	8	8				
Oligochaeta	8		32	40		8	24	32
Glycinde polygnatha			8					

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
				Station # 13				
Heteromastus filiformis								
Streblospio benedicti			56	32	24	24	112	64
Eteone lighti				8	8			
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8	24	32	16	16	8
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri			96	96	16	24	40	40
Microdeutopus schmitti								
Corophium ascherusicum								
Sarsiella spp.								
Oligochaeta			24	24	16	8	16	

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
				Station # 14				
Heteromastus filiformis								
Streblospio benedicti	112	128			24	48	16	40
Eteone lighti		8			8			
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	352	456			60	40	32	8
Microdeutopus schmitti								
Corophium ascherusicum								
Sarsiella spp.								
Oligochaeta	16	24			48	72	40	24

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 15 A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	32	8	24	32	64	80	56	40
Eteone lighti					8			8
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	96	80	24	48	64	72	32	32
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	8	16	8	16	8	8	24	8

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	Station # 16 A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	8		8		8	8		
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	16		8		8	8		
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	56	32	32	56	88	64		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	32	16	56	40	32		
Cumacean						8		

** The value for each sum-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Station #17

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	40	24			16	16		
Eteone lighti	8	8			8			
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei					8			
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	8	64				16		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	40	40			48	16		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Station # 18

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	408	368	448	480			488	360
Eteone lighti	8							
Eteone californica								
Pseudopolydora kempi			8					16
Polydora ligni								
Exogone lourei		8	8					
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	272	200	408	320			344	264
Microdeutopus schmitti		8						
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	64	72	32	24			40	16

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate **Sub-sample**	A 1	 2	B 1	 2	Station #19 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	8	16	24	40	48	64	64	88
Eteone lighti	16	8	8	16	24	16	24	24
Eteone californica								
Pseudopolydora kempi				16		16	16	8
Polydora ligni								
Exogone lourei								
Chaetozone sp.						8	8	
Capitella capitata								
Ampelisca milleri	72	40	104	128	88	40	216	128
Microdeutopus schmitti					16		8	
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	16	48	48	48	48	48	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate **Sub-sample**	A 1	 2	B 1	 2	Station #20 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	24	16	32	8	40	32	24	48
Eteone lighti			16	8	8	8		24
Eteone californica								
Pseudopolydora kempi								8
Polydora ligni								
Exogone lourei								
Chaetozone sp.					8		8	
Capitella capitata								
Ampelisca milleri	24	48	80	216	24	72	208	184
Microdeutopus schmitti					8			
Corophium ascherusicum			8					
Sarasiella spp.								
Oligochaeta	72	64	80	88	56	80	56	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate **Sub-sample**	**A** 1	 2	**B** 1	 2	**C** 1	 2	**D** 1	 2
			Station #21					
Heteromastus filiformis								
Streblospio benedicti	48	64			64	48		
Eteone lighti	8	16			24	8		
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	152	144			896	968		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	72	48			96	112		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate **Sub-sample**	**A** 1	 2	**B** 1	 2	**C** 1	 2	**D** 1	 2
			Station #22					
Heteromastus filiformis								
Streblospio benedicti	16	16	8	16	40	48	96	120
Eteone lighti	16		16	8	32	24	8	16
Eteone californica								
Pseudopolydora kempi	8							
Polydora ligni					8	16	24	8
Exogone lourei								
Chaetozone sp.								16
Capitella capitata								
Ampelisca milleri	144	104	136	152	352	224	256	296
Microdeutopus schmitti								
Corophium ascherusicum							8	
Sarasiella spp.								
Oligochaeta	32	40	32	40	64	56	48	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	Station #23 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti			8				24	
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8				8	16
Chaetozone sp.				8				8
Capitella capitata								
Ampelisca milleri	16		8	8				16
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	56	80	80	48	80	96	72	64
Cumacean	8							

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	Station # 24 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	8	8			8	8	24	8
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei				8		8		
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	8			8			8	8
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	56	48	40	56	40	48	40	80

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
	Station # 25							
Heteromastus filiformis								
Streblospio benedicti	184	160	40	40	40	24	40	24
Eteone lighti	8	8						
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	432	568	576	544	24	72	80	64
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	88	64	56	48	24	40	88	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
	Station #26							
Heteromastus filiformis								
Streblospio benedicti	24	8	72	80	72	24	80	96
Eteone lighti	16	8	32	24	16	24	8	
Eteone californica								
Pseudopolydora kempi					8			
Polydora ligni								
Exogone lourei					8			
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	504	736	808	712	720	864	712	744
Microdeutopus schmitti	8	16	8					
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	32	40	64	32	48	64	56

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Station #27								
Heteromastus filiformis								
Streblospio benedicti	40	24						16
Eteone lighti			8		8			
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	72	32	64	112	120	152	128	96
Chaetozone sp.								
Capitella capitata								
Ampelisca-milleri	8	8		8	16	8	24	8
Microdeutopus schmitti			8					
Corophium acherusicum				8				
Sarasiella spp.								
Oligochaeta	64	56	32	72	104	96	104	112

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Station #28								
Heteromastus filiformis								
Streblospio benedicti	32	24	88	32	48	16	72	48
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei				8	32	16	16	8
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	24	16	80	24	56	64	48	48
Microdeutopus schmitti								
Corophium acherusicum								
Sarasiella spp.								
Oligochaeta	48	24	24	32	40	64	56	72

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station # 29

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	40	24	152	120	24	24	24	48
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			88	72	64	80	8	24
Chaetozone sp.				8				
Capitella capitata								
Ampelisca milleri	416	648	224	128	464	448	896	848
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	40	120	72	96	64	24	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

October, 1975

Station # 30

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti			56	16		16		8
Eteone lighti					16			
Eteone californica								
~~*Pseudopolydora kempi*~~								
Polydora ligni								
Exogone lourei			32	64	32	24	32	24
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri			136	160	136	160	16	72
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta			40	32	32	32	48	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Replicate	A		B		Station # 1 C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	1208	1184	400	304	824	584	1120	1128
Eteone lighti		16			16			8
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8				8	
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri		8						24
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	304	424	280	288	464	392	328	304

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Replicate	A		B		Station # 5 C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	184	232	320	328	176	136	368	304
Eteone lighti	40	48	16	32	8	16	24	24
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	8		8				24	16
Chaetozone sp.								
Capitella capitata								
Ampelisca-milleri	136	248	160	168	96	88	168	128
Microdeutopus schmitti		8						
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	56	32	88	80	72	64	104	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station #6

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	320	328	392	424	240	376	512	496
Eteone lighti	24		8	8	32	48	8	16
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	16	16	24	32	8	16	16	40
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	24	128	160	120	160	216	128	80
Microdeutopus schmitti	8							
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	136	56	72	64	48	72	32	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 7

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	32		24	40	24	8	64	48
Eteone lighti	16		8	8				
Eteone californica								
Pseudopolydora kempi				8				
Polydora ligni								
Exogone lourei	56	104	56	48	96	104	112	120
Chaetozone sp.					8		8	
Capitella capitata								
Ampelisca milleri		24	8	8		8		
Microdeutopus schmitti								8
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	104	112	48	72	80	56	72	56

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 8

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	96	64	80	32	136	104	104	128
Eteone lighti								
Eteone californica								
Pseudopolydora kempi					8		8	
Polydora ligni								
Exogone lourei	48	96	96	144	136	64	144	184
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	136	96	64	64	24	56	24	64
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	112	104	72	104	40	56	128	88

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 9

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	64	48	48	88	120	48	136	144
Eteone lighti		8				8		
Eteone californica								
Pseudopolydora kempi						8		
Polydora ligni								
Exogone lourei	552	608	552	696	752	688	744	608
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	80	128	40	80	88	144	104	128
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	64	40	16	16	48	48	64	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Replicate Sub-sample	A 1	 2	B 1	 2	Station #10 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	56	16	160	96	152	102	176	88
Eteone lighti			8		8			8
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	16	8	144	120	88	136	72	88
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri			72	128	80	48	56	16
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	56	40	48	56	40	32	40	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Replicate Sub-sample	A 1	 2	B 1	 2	Station #11 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	424	456	160	216	160	120	360	288
Eteone lighti			8			8		8
Eteone californica								
Pseudopolydora kempi					8			
Polydora ligni								
Exogone lourei	8	16	16	8	40	8	8	
Chaetozone sp.					8	8		
Capitella capitata								
Ampelisca milleri	16	8	16		8	8	16	16
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	56	40	48	40	64	56	96	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 12

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	136	72	152	72	80	112	248	168
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	32	64	48	24	144	96	48	72
Chaetozone sp.	8	8						
Capitella capitata								
Ampelisca milleri	448	304	168	112	248	144	104	184
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	32	48	16	48	32	40	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 13

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	144	192	144	96	120	96	136	136
Eteone lighti					8	8		
Eteone californica								
Pseudopolydora kempi			24					
Polydora ligni								
Exogone lourei	136	128	280	336	160	304	224	136
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	24	16	8	8	48	64		16
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	80	56	72	88	40	24	72	32

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

	Station #18							
Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	96	40	144	136	96	160	184	152
Eteone lighti			8			8		8
Eteone californica								
Pseudopolydora kempi	8	8		8				
Polydora ligni								
Exogone lourei	136	96	64	56	104	120	88	40
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	376	344	160	240	336	384	328	392
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	24	16	16	40	48	24	32

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

	Station #19							
Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	104	200	152	192	96	136	128	200
Eteone lighti			16	8	16	8		
Eteone californica								
Pseudopolydora kempi	8							
Polydora ligni								
Exogone lourei	40	136	48	40	24	40	72	88
Chaetozone sp.	8							
Capitella capitata								
Ampelisca milleri	176	200	160	176	176	200	104	176
Microdeutopus schmitti	8					8		
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	48	24	16	32	24	48	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 20

Replicate Sub-sample	A 1	2	B 1	2	C 1	2	D 1	2
Heteromastus filiformis								
Streblospio benedicti	64	176	152	184	168	184	216	208
Eteone lighti		8			32	40	8	8
Eteone californica								
Pseudopolydora kempi					16		8	8
Polydora ligni								
Exogone lourei	40	96	80	104	48	40	72	80
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	56	80	96	24	72	48	24	48
Microdeutopus schmitti					8	8		
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	96	104	64	80	56	88	48	72

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station # 25

Replicate Sub-sample	A 1	2	B 1	2	C 1	2	D 1	2
Heteromastus filiformis								
Streblospio benedicti	376	408	232	168	192	144	224	216
Eteone lighti	8			8	8		8	8
Eteone californica								
Pseudopolydora kempi								8
Polydora ligni								
Exogone lourei	8	24	32	24	40	8	24	32
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	312	232	144	216	168	152	112	136
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	32	48	40	64	72	24	40

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

January, 1976

Station #30

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	24	40	64	48	56	32	120	112
Eteone lighti		8	8				8	
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	8	16	8	24	8		32	16
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	56	32	48	72	8	48	568	360
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	32	24	16	24	8	56	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

May, 1976

Station #1

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	256	176	224	56	208	144	152	160
Eteone lighti						8		8
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri							16	16
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.			16					
Oligochaeta	632	432	608	816	568	416	320	392

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

May, 1976

Station # 5

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospio benedicti	56	40	8	40	104	48	40	16
Eteone lighti		8		16	32	24		16
Etnone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8		8	8	8	
Chaetozone sp.								
Capitella capitata								8
Ampelisca milleri	128	104	56	64	40	48	360	256
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.	32	8				8	8	
Oligochaeta	160	152	104	232	88	64	208	240
Cumaceans		24						
Gemma gemma	8							

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

May, 1976

Station # 6

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
Heteromastus filiformis								
Streblospic benedicti	200	136	120	144	184	128	88	80
Eteone lighti	24		16	8	24	24	8	16
Eteone californica								
Pseudopolydora kempi								
Polydora ligni					24	8		
Exogone lourei	8							
Chaetozone sp.								
Capitella capitata			8					
Ampelisca milleri	80	248	120	48	136	160	360	360
Microdeutopus schmitti								
Corophium ascherusiam		8						
Sarasiella spp.								
Oligochaeta	256	160	376	352	32	40	24	48
Cumaceans							8	

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

May, 1976

Replicate Sub-sample	A 1	 2	B 1	 2	Station # 7 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	8	8	32		8	32	32	40
Eteone lighti					24			
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	216	304	152	280	136	144	56	112
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	384	464	240	272	88	112	112	240
Microdeutopus schmitti								
Corophium acherusicum								
Sarasiella spp.		8	24	8	16	8	16	
Oligochaeta	48	80	96	72	304	264	272	416
Cumaceans		8		8				

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

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Faunal List

0.5 mm Screen Size

May, 1976

Replicate Sub-sample	A 1	 2	B 1	 2	Station #8 C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	32	16	80	32	32	64	16	8
Eteone lighti	16	8			16			
Eteone californica				16				
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	136	216	192	192	48	64	104	168
Chaetozone sp.								
Capitella capitata								8
Ampelisca milleri	8	40	224	200	56	80	32	48
Microdeutopus schmitti								
Corophium acherusicum		8						
Sarasiella spp.		16	16			16		
Oligochaeta	240	208	208	224	328	512	424	360
Cumaceans		16	16	8				
Glycinde polygnatha				8				

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station # 9

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	80	136	96	104	48	96	72	136
Eteone lighti				8				
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	96	120	112	160	80	64	168	176
Chaetozone sp.								
Capitella capitata	8							
Ampelisca milleri	48	80			40	16		
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.			8					16
Oligochaeta	112	80		16			72	56
Cumaceans			16	8				
Scolelepis squamatus	8							

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station #10

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteromastus filiformis			8					
Streblospio benedicti	88	112	32	16	72	48	24	8
Eteone lighti	16	16					16	8
Eteone californica	16							
Pseudopolydora kempi								
Polydora ligni	8		8				8	
Exogone lourei	336	520	160	172	288	232	128	184
Chaetozone sp.								
Capitella capitata		8					16	
Ampelisca milleri	432	584	112	48	864	592	256	352
Microdeutopus schmitti	40	16		8				56
Corophium ascherusicum	24							
Sarasiella spp.								
Oligochaeta								8
Harmathoe imbresata		8						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station # 11

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteronastus filiformis		8						
Streblospio benedicti	16	32	24	16			40	88
Eteone lighti			8	8			8	
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	40	48					48	16
Chaetozone sp.								
Capitella capitata							8	
Ampelisca milleri								
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	48	24	16	56	24	32	56	128

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station # 12

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteronastus filiformis								
Streblospio benedicti	48		40	24		8	8	
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	416	312	96	224	416	336	240	216
Chaetozone sp.							8	
Capitella capitata								
Ampelisca milleri	152	176	16	8	96	168	32	24
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	64	64	48	24	32	16	40	16

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station #13

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Heteromastus filiformis		8	16		16	24		
Streblospio benedicti	48	16	56	56	88	48	40	24
Eteone lighti			8	8		24	24	16
Eteone californica	8	24		8	8		8	8
Pseudopolydora kempi								
Polydora ligni		8	16	32	8		16	
Exogone lourei	160	184	160	172	56	128	48	104
Chaetozone sp.								
Capitella capitata	16		8	8	16	16	16	
Ampelisca milleri	368	592	216	304	232	152	144	344
Microdeutopus schmitti		8	24	8		8	40	24
Corophium ascherusicum		24						
Sarasiella spp.					8			
Oligochaeta	72	56	96	40	168	96	120	64
Cumaceans					8			

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station # 18

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Heteromastus filiformis								
Streblospio benedicti	880	520	936	840	1336	1088	840	880
Eteone lighti	40	24	48	128	40	24	48	72
Eteone californica						8	8	8
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei		24		24	8		16	16
Chaetozone sp.								
Capitella capitata					16			
Ampelisca milleri	64	88	104	184	136	96	172	208
Microdeutopus schmitti							16	
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	16	72	64	64	48	64	24	48
Cumaceans	8	24		8				8

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Replicate **Sub-sample**	A 1	 2	B 1	 2	C 1	 2	D 1	 2
	Station #19							
Heteromastus filiformis				16	8			
Streblospio benedicti	240	400	240	104	216	280	216	168
Eteone lighti	8	24	32	24	16	56	8	16
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	16	24				16		8
Exogone lourei	8	8		32				8
Chaetozone sp.								
Capitella capitata				32	16	32		
Ampelisca milleri	16	8						8
Microdeutopus schmitti	8	8	8	8				
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	32	48	152	144	152	280	88	64
Cumaceans	8							

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Replicate **Sub-sample**	A 1	 2	B 1	 2	C 1	 2	D 1	 2
	Station #20							
Heteromastus filiformis								
Streblospio benedicti	72	40	80	32	64	80	56	88
Eteone lighti							8	8
Eteone californica								8
Pseudopolydora kempi								
Polydora ligni							8	8
Exogone lourei								
Chaetozone sp.							8	16
Capitella capitata	16						32	56
Ampelisca milleri								
Microdeutopus schmitti								
Corophium ascherusicum								
Sarasiella spp.	40			8				
Oligochaeta	512	560	184	200	496	400	296	384
Amaeana occidentalis							8	

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station # 25

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Heteromastus filiformis				8	8			
Streblospio benedicti	88	104	104	56	80	80	112	120
Eteone lighti							8	
Eteone californica								
Pseudopolydora kempi								
Polydora ligni		8				8	48	16
Exogone lourei					8	16		8
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	32	128					168	432
Microdeutopus schmitti	80	72			8		56	56
Corophium ascherusicum	8	16						26
Sarasiella spp.							16	
Oligochaeta	80	80	64	56	168	136		8
Cumaceans							8	8
Harmathoe imbricata							8	

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

May, 1976

Station #30

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Heteromastus filiformis							16	
Streblospio benedicti	208	112	112	144	64	112	16	72
Eteone lighti	24	8		32		16	80	16
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	16		16	32				
Exogone lourei					24			
Chaetozone sp.								
Capitella capitata	8	24	16	8			16	24
Ampelisca milleri	400	248	208	224	680	632	376	592
Microdeutopus schmitti	48	32	40	48	8		48	56
Corophium ascherusicum	24		16				8	
Sarasiella spp.					16	8		
Oligochaeta	72	88	24	16	32	32	96	
Harmathoe imbricata	8	8						

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station # 1

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteronastus filiformis								
Streblospio benedicti	200	144	96	48	152	184	128	112
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	40	56	32				48	16
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	104	120	64	32	80	64	64	24
Microdeutopus schmitti	72	96	152	184	72	56	48	64
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	480	624	264	224	504	568	440	376

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station # 5

Replicate Sub-sample	A 1	 2	B 1	 2	C 1	 2	D 1	 2
Heteronastus filiformis								
Streblospio benedicti	176	144	248	320	224	256	216	264
Eteone lighti							8	
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	32	16	8	16				
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	224	280	248	192	288	192	184	176
Microdeutopus schmitti	56	48	16	48	16	48	32	48
Corophium ascherusicum								
Sarasiella spp.	8			32	24		8	16
Oligochaeta	16			24	72	120	64	96

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	A 1	 2	B 1	Station #6 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti	56	80	144	224	120	176	152	200
Eteone lighti	24	16	8			8		
Eteone californica							16	
Pseudopolydora kempi								
Polydora ligni				8	8	24	8	
Exogone lourei			48	24	40	24	48	
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	48	64	104	120	80	136	120	144
Microdeutopus schmitti	16	8	24		16	16	32	48
Corophium ascherusicum						8		
Sarasiella spp.	16	8						
Oligochaeta								
Gemma gemma	16		24	24			24	48
Dorvillea sp.						8		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	A 1	 2	B 1	Station #7 2	C 1	 2	D 1	 2
Heteromastus filiformis								
Streblospio benedicti		16	8					
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8	24			16	32
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	16	32	8	8			24	
Microdeutopus schmitti	8						8	
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	8	24	16				24	48

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station #8

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis				16				
Streblospio benedicti	80	104	72	88	40	72	64	112
Eteone lighti		16					8	
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	64	32			32	48	24	56
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	120	160	80	48	96	144	176	104
Microdeutopus schmitti					16	8		
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta	40	24	48	64	32	40	24	

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station # 9

Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	64	48	64	16	72	32	56	48
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni				8				
Exogone lourei	128	80	96	120	48	72	144	104
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	104	120	72	96	112	80	128	128
Microdeutopus schmitti		8	24	8	16	24	24	32
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta			24					

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station # 10

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis	8				16			
Streblospio benedicti		48	24	40	32	64		48
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni				8	16	8		8
Exogone lourei	64	48	96	80	96	80	128	96
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	120	88	104	144	88	120	64	112
Microdeutopus schmitti								
Corophium acherusicum					8			8
Sarasiella spp.								
Oligochaeta					24	48		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Station #11

Replicate	**A**		**B**		**C**		**D**	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis							16	
Streblospio benedicti	24	40	48	72	72	48	96	80
Eteone lighti	8			8				
Eteone californica					8			
Pseudopolydora kempi								
Polydora ligni		8		8				
Exogone lourei					32	80	24	
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	64	56	8	32	16	40	24	16
Microdeutopus schmitti		8		8				
Corophium acherusicum								
Sarasiella spp.								
Oligochaeta								
Gemma gemma					40	24		

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate	**Station #12**							
	A		**B**		**C**		**D**	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti	80	48	16	64	16	48	56	32
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	8			8		8		
Exogone lourei		8	32	32	48	32	24	72
***Chaetozone* sp.**								
Capitella capitata								
Ampelisca milleri	32	40	72	48	48	56	40	40
Microdeutopus schmitti								
Corophium ascherusicum								
***Sarasiella* spp.**	24	8		16		24	24	32
Oligochaeta								

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate	**Station #13**							
	A		**B**		**C**		**D**	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis								
Streblospio benedicti								
Eteone lighti		8						
Eteone californica								
Pseudopolydora kempi								
Polydora ligni							8	
Exogone lourei	168	152			120	184	88	128
***Chaetozone* sp.**								
Capitella capitata								
Ampelisca milleri	40	64			80	56	96	152
Microdeutopus schmitti					16		8	
Corophium ascherusicum								
***Sarasiella* spp.**							24	16
Oligochaeta								

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
				Station # 18				
Heteromastus filiformis			8					
Streblospio benedicti	120	72	320	264	368	248	312	248
Eteone lighti								8
Eteone californica		8			8			8
Pseudopolydora kempi								
Polydora ligni		8	40	8				
Exogone lourei								
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	56	16	96	120	112	200	240	208
Microdeutopus schmitti		8		48	48	40	72	32
Corophium acherusicum								
Sarasiella spp.					24		24	48
Oligochaeta					64	24	96	24
Gemma gemma	80	56	16	112	64	40	24	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	A 1	A 2	B 1	B 2	C 1	C 2	D 1	D 2
				Station # 19				
Heteromastus filiformis				8	8			
Streblospio benedicti	312	232	144	208	184	288	192	240
Eteone lighti								
Eteone californica							16	
Pseudopolydora kempi								
Polydora ligni					16	8	8	24
Exogone lourei								
Chaetozone sp.	16		8	8				
Capitella capitata								
Ampelisca milleri	104	144	32	8	64	24	56	32
Microdeutopus schmitti	24	64	48	16	24	24	24	8
Corophium acherusicum								
Sarasiella spp.	48	32	24	16	48	16	24	48
Oligochaeta	40	72						
Gemma gemma	24	40		8	64	32	40	72

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	Station #20 A 1	 A 2	 B 1	 B 2	 C 1	 C 2	 D 1	 D 2
Heteromastus filiformis			8				8	
Streblospio benedicti	72	48	24	80	72	16	64	80
Eteone lighti								
Eteone californica	8		16					
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei	264	328	216	312	120	64	320	264
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	144	176	96	64	16	24	272	216
Microdeutopus schmitti						8	32	48
Corophium ascherusicum								
Sarasiella spp.								
Oligochaeta					48		16	32

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

Replicate Sub-sample	Station # 25 A 1	 A 2	 B 1	 B 2	 C 1	 C 2	 D 1	 D 2
Heteromastus filiformis								
Streblospio benedicti	16	40	24	56	24	16	32	24
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni	16		8			8	8	
Exogone lourei					72	48		
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri	96	128	96	104	56	72	88	120
Microdeutopus schmitti	16	32	24	8	8	16	32	16
Corophium ascherusicum								
Sarasiella spp.						16	8	16
Oligochaeta	8	24	48	16				
Cumacean						8	8	
Anaeana occidentalis					8			
Gemma gemma	16	8		24	16			

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

Appendix VII

Faunal List

0.5 mm Screen Size

August, 1976

	Station #30							
Replicate	A		B		C		D	
Sub-sample	1	2	1	2	1	2	1	2
Heteromastus filiformis			8					
Streblospio benedicti			8	16	8			
Eteone lighti								
Eteone californica								
Pseudopolydora kempi								
Polydora ligni								
Exogone lourei			8	16	48	32	16	24
Chaetozone sp.								
Capitella capitata								
Ampelisca milleri			24	16	96	56	160	128
Microdeutopus schmitti								
Corophium acherusicum								
Sarsiella spp.								
Oligochaeta				24	32	48	48	64

** The value for each sub-sample estimates the total number of individuals per replicate collected by the Ponar grab.

H2 WATER QUALITY ANALYSES

PACIFIC ENVIRONMENTAL LABORATORY
OCTOBER 1975 - AUGUST 1976

PACIFIC ENVIRONMENTAL LABORATORY
557 HOWARD STREET
SAN FRANCISCO CALIF 94105
TELEPHONE (415) 392-6068

8 January 1976

Bechtel Corporation
P.O. Box 3965
San Francisco, Ca. 94120

Attention: Dr. C. H. Harper
Environmental Services Department

Subject: S.B.D.A. - Water Analyses
(5048)

Gentlemen:

As requested, information regarding the analytical methods used for the water samples of the South Bay Dischargers Authority, Bechtel Project 10035-005, received on 2 September 1975 and 17 October 1975 are described herein:

Methods

The analytical methods used were as outlined in the "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures", Federal Register, Volume 40, No. 111, 9 June 1975.

Sampling

The water samples were collected by Bionomic personnel and delivered to the laboratory on the date of sampling. Four types of samples were submitted; (1) unpreserved for general analyses; (2) Nitric acid preserved for heavy metals; (3) Sulfuric acid preserved for nitrogen; and (4) Water sample in sterilized bottles for Coliform.

Sample Storage

All samples were kept in the refrigerator until all of the analyses were completed and checked, except for the heavy metals samples which were not refrigerated.

Summary of Analyses and Storage

The parameters, analytical methods and analytical periods are summarized as follows:

Parameter	Analytical Method	Analytical Period(1)
Apparent Color	SM(2)	Date Received
T. Dissolved Solids	EPA(3)	1 - 6 days
Total Solids	EPA(3)	3 - 10 days
Specific Conductance	SM(2)	1 - 3 days
Turbidity	SM(2)	1 - 5 days
Total Alklainity	SM(2)	1 - 2 days
Chloride	SM(2)	3 - 7 days
T. Hardness	SM(2)	3 - 7 days
Ammonia Nitrogen	EPA(3)	1 - 2 days(4)
Nitrate Nitrogen	SM(2)	1 - 2 days(4)
Nitrite Nitrogen	EPA(3)	1 - 2 days(4)
Total Kjeldahl Nitrogen	SM(2)	1 - 5 days(4)
B.O.D.	SM(2)	Date Received
H. Metals	SM(2)	2 - 15 days
Reactive Phosphorous	EPA(3)	Date Received
T. Phosphorous	EPA(3)	1 - 5 days
Silica	SM(2)	3 - 7 days
Sodium	SM(2)	2 - 10 days
Sulfate	SM(2)	3 - 7 days
Total & Fecal Coliform	SM(2)	Date Received

Note:

(1) "Date Received" means the analyses were performed or dilution and incubation started on the date samples were received.

Obviously, for some parameters, all analyses were not performed on the same date and for certain analyses, pretreatments were required prior to analyses. For example, designation "1 - 5 days" means either the analyses or pretreatment of the samples were started within 24 hours after the samples were received and the analyses completed in 5 days or less.

(2) "Standard Methods for the Examination of Water and Wastewater", 13th Edition, APHA.

(3) "Manual of Methods for Chemical Analysis of Water and Wastes", 1974, Environmental Protection Agency.

(4) Because of the weekend, most of the nitrogen analyses for 10/17/75 samples were performed on third day.

I hope this letter sufficiently explains the careful adherence to proper storage and analytical methods practiced by our laboratory to provide accurate results. We are available to discuss any further questions in greater detail.

Very truly yours,

PACIFIC ENVIRONMENTAL LABORATORY

Robert A. Ryder

Robert A. Ryder
Director

RAR:fb

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
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Received 9/2/75
Reported 9/22/75

WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P. O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753675	753676	753677	753678
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	Sta. A	Sta. B	Sta. C	Sta. D
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1045	1120	1130	1145

Collected and Delivered by E. Smith and D. R. Williams of Bionomics

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	120	72	78	59
TOTAL DISSOLVED SOLIDS	Mg/L	19,300	21,800	23,200	24,000
TOTAL SOLIDS	Mg/L	20,500	22,100	25,200	24,200
SPECIFIC CONDUCTANCE	Micromhos cm	27,500	28,000	30,800	31,900
TURBIDITY	JTU	17	8.9	11	8.0
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	202	200	192	186
CHLORIDE (Cl)	Mg/L	10,000*	11,500	13,250	13,250
TOTAL HARDNESS ($CaCO_3$)	Mg/L	3,600	3,800*	4,300	4,400
AMMONIA NITROGEN (N)	Mg/L	<0.06	<0.06	0.56	0.22
NITRATE NITROGEN (N)	Mg/L	0.77	0.77	0.68*	0.69
TOTAL NITROGEN (N)	Mg/L	3.74	2.90	4.19	2.74
B.O.D., 5-DAY, 20°C	Mg/L	2.2	1.4	<1.0	<1.0

COMMENTS: *Analytical Quality Control Sample.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register. Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB Analyst

R. A. Ryder Director
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
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Received 9/2/75
Reported 9/22/75

WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION **REPORT TO** DR. C. M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753675	753676	753677	753678
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005	Sta. A	Sta. B	Sta. C	Sta. D
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1045	1120	1130	1145

Collected and Delivered by E. Smith and D. R. Williams of Bionomics

Analysis	**Units**	**ANALYTICAL RESULTS**			
SALINITY	°/oo	18	21	24	24
IRON (Fe) (1)	Mg/L	1.33	0.68*	0.88	0.39
CADMIUM (Cd) (1)	Mg/L	<0.005	<0.005*	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.01	0.02*	0.02	0.02
MERCURY (Hg) (2)	Mg/L	0.0004	<0.0002	0.0002	<0.0002
ZINC (Zn) (1)	Mg/L	0.026	0.113*	0.038	0.052
REACTIVE PHOSPHOROUS (P)	Mg/L	0.72	0.84	0.94	0.88
TOTAL PHOSPHOROUS (P)	Mg/L	0.82	0.90	1.04	1.10
SILICA (SiO_2)	Mg/L	15*	17	11	11
SODIUM (Na) (1)	Mg/L	5,000	7,500	7,000	8,000
SULFATE (SO_4)	Mg/L	1,250	1,310	1,530	1,600
TOTAL COLIFORM	MPN/100ml	490	170	170	49
FECAL COLIFORM	MPN/100ml	170	33	110	33

COMMENTS:

*Analytical Quality Control Sample
(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB **Analyst**

R.A.Ryder **Director**
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION **REPORT TO** DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753679	753680	753681	753682
SOURCE OF SAMPLE:	Sta. E.	Sta. F.	Sta. G.	Sta. H
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1205	1220	1235	1255

Collected and Delivered by E. Smith and Dr. R. Williams of Bionomics

Analysis	**Units**	**ANALYTICAL RESULTS**			
APPARENT COLOR	Color Unit	174	44	49	49
TOTAL DISSOLVED SOLIDS	Mg/L	20,500	24,300	22,100	24,700
TOTAL SOLIDS	Mg/L	22,400	26,100	23,300	26,800
SPECIFIC CONDUCTANCE	Micromhos/cm	28,000	33,300	30,300	34,100
TURBIDITY	JTU	28	5.5	5.9	6.7
TOTAL ALKALINITY (Ca CO_3)	Mg/L	198	172	182	182
CHLORIDE (Cl)	Mg/L	11,500	14,000	12,800	14,000
TOTAL HARDNESS ($CaCO_3$)	Mg/L	3,800	4,700	4,200	4,700
AMMONIA NITROGEN (N)	Mg/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	Mg/L	0.72	0.66	0.71	0.73
TOTAL NITROGEN (N)	Mg/L	3.56	1.91	2.24	2.00
B.O.D., 5-DAY, 20°C	Mg/L	2.4	<1.0	<1.0	<1.0

COMMENTS:

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB **Analyst**

R.A.Ryder **Director**
R. A. Ryder

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT

ADDRESS P. O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753679	753680	753681	753682
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005	Sta. E	Sta. F	Sta. G	Sta. H
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1205	1220	1235	1255

Collected and Delivered by E. Smith and D. R.Williams of Bionomics

Analysis	**Units**	**ANALYTICAL RESULTS**			
SALINITY	$^{o}/oo$	21	25	23	25
IRON (FE) (1)	Mg/L	3.1*	0.44	0.32	0.65
CADMIUM (Cd) (1)	Mg/L	<0.005*	<0.005	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.05*	0.01	0.02	0.01
MERCURY (Hg) (2)	Mg/L	<0.0002	0.0004	0.0002	0.0002
ZINC (Zn) (1)	Mg/L	0.049*	0.044	0.033	0.042
REACTIVE PHOSPHOROUS (P)	Mg/L	0.30	0.94	0.96	0.78
TOTAL PHOSPHOROUS (P)	Mg/L	0.46	0.96	1.06	0.82
SILICA (SiO_2)	Mg/L	12	11*	12	11
SODIUM (Na) (1)	Mg/L	6,500	8,000	6,000	8,500
SULFATE (SO_4)	Mg/L	1,370	1,670	1,500	1,670
TOTAL COLIFORM	MPN/100ml	790	11	46	5
FECAL COLIFROM	MPN/100ml	330	2	13	<2

COMMENTS:

*Analytical Quality Control Analysis
(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register. Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB Analyst

R.A. Ryder Director
R. A. Ryder

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT.

ADDRESS P. O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753683	753684	753685	753686
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	Sta. I	Sta. J	Sta. K	Sta. L
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1305	1335	1335	1335

Collected and Delivered by E. Smith and D. R. Williams of Bionomics

Analysis	**Units**	**ANALYTICAL RESULTS**			
APPARENT COLOR	Color Unit	33	38	38	33
TOTAL DISSOLVED SOLIDS	Mg/L	26,700	27,100	27,800	27,700
TOTAL SOLIDS	Mg/L	29,000	31,200	29,900	29,600
SPECIFIC CONDUCTANCE	Micromhos cm	35,600	37,400	38,000	36,300
TURBIDITY	JTU	4.4	5.2	5.2	4.3
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	154	128	136	152
CHLORIDE (Cl)	Mg/L	15,500	16,000	15,800	15,800
TOTAL HARDNESS ($CaCO_3$)	Mg/L	5,100	5,100	5,300	5,300
AMMONIA NITROGEN (N)	Mg/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	Mg/L	0.48	0.42*	0.37	0.38
TOTAL NITROGEN (N)	Mg/L	1.12	1.03	0.98	1.00
B.O.D., 5-DAY, 20°C	Mg/L	<1.0	<1.0	<1.0	<1.0

COMMENTS:

* Analytical Quality Control Analysis

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register. Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB Analyst

R.A. Ryder Director
R. A. Ryder

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	753683	753684	753685	753686
SOURCE OF SAMPLE:	Sta. I	Sta. J	Sta. K	Sta. L
South Bay Discharger Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	9/2/75	9/2/75	9/2/75	9/2/75
TIME COLLECTED:	1305	1335	1335	1335

Collected and Delivered by E. Smith and D. R. Williams of Bionomics

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	28	29	29	29
IRON (Fe) (1)	Mg/L	0.33*	0.39	0.43	0.34
CADMIUM (Cd) (1)	Mg/L	<0.005*	<0.005	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.03*	0.01	0.01	<0.01
MERCURY (Hg) (2)	Mg/L	0.0002*	0.0002	0.0003	<0.0002*
ZINC (Zn) (1)	Mg/L	0.048*	0.029	0.054	0.032
REACTIVE PHOSPHOROUS (P)	Mg/L	0.44	0.44	0.52	0.56*
TOTAL PHOSPHOROUS	Mg/L	0.72	0.52	0.58	0.68*
SILICA (SiO_2)	Mg/L	9	8	8*	8
SODIUM (Na) (1)	Mg/L	8,000	8,000	8,000	8.000
SULFATE (SO_4)	Mg/L	1,880	2,100	2,050	1,880
TOTAL COLIFORM	MPN/100ml	2	(3)	(3)	2*
FECAL COLIFORM	MPN/100ml	<2	(3)	(3)	<2*

COMMENTS:

*Analytical Quality Control Analysis
(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer
(3) Sample not submitted for analysis

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN, SDR, NH, CB Analyst

R.A. Ryder Director
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
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Received 10/17/75
Reported 11/5/75

WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754949	754950	754951	754952
SOURCE OF SAMPLE:	Sta. M.	Sta. N	Sta. O	Sta. P
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:	--	--	--	--
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1040	1040	1040	1115

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	10	8	10	13
TOTAL DISSOLVED SOLIDS	Mg/L	28,600	28,100	28,100	29,400
TOTAL SOLIDS	Mg/L	33,200	32,300	32,900	32,200
SPECIFIC CONDUCTANCE	Micromhos / cm	44,100	43,600	44,300	44,300
TURBIDITY	JTU	7.4	7.8	6.1	1.9
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	138	140	130	128
CHLORIDE (Cl)	Mg/L	15,500	15,500	16,000	16,000
TOTAL HARDNESS ($CaCO_3$)	Mg/L	5,300	5,300	5,200	5,200
AMMONIA NITROGEN (N)	Mg/L	0.17	<0.06	<0.06	<0.06 *
NITRATE NITROGEN (N)	Mg/L	0.79	0.83	0.91	0.91
TOTAL NITROGEN (N)	Mg/L	1.40	1.99	1.81	1.80
B.O.D., 5-DAY, 20°C	Mg/L	<1.0	<1.0	<1.0	<1.0

COMMENTS:

*Analytical Quality Control Analysis

Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN TN Analyst

R.A. Ryder Director
R. A. Ryder

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754949	754950	754951	754952
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005	Sta. M	Sta. N	Sta. O	Sta. P
TREATMENT:				
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1040	1040	1040	1115

Analysis	**Units**	**ANALYTICAL RESULTS**			
SALINITY	°/oo	28	28	29	29
IRON (Fe) (1)	Mg/L	0.38	0.37	0.23	0.42
CADMIUM (Cd) (1)	Mg/L	<0.005	<0.005	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.03	0.05	0.03	0.07
MERCURY (Hg) (2)	Mg/L	0.0011	0.0012	0.0012	0.0008
ZINC (Zn) (1)	Mg/L	0.061	0.060	0.074	0.033
REACTIVE PHOSPHOROUS (P)	Mg/L	0.60	0.55	0.60	0.52
TOTAL PHOSPHOROUS (P)	Mg/L	0.62	0.55	0.62	0.52
SILICA (SiO_2)	Mg/L	11	10	10	11
SODIUM (Na) (1)	Mg/L	8,000	8,500	7,300	8,000
SULFATE (SO_4)	Mg/L	2,000	1,830	1,830	1,880
TOTAL COLIFORM	MPN/100ml	23	49*	79	23
FECAL COLIFORM	MPN/100ml	2	3*	2	<2

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer
Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN /TN Analyst

R.A. Ryder Director
R. A. Ryder

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(PEL 5048) Page 3 of 8

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754953	754954	754955	754956
SOURCE OF SAMPLE:	Sta. Q	Sta. R	Sta. S	Sta. T
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1115	115	1115	1220

Analysis	**Units**	**ANALYTICAL RESULTS**			
APPARENT COLOR	Color Unit	16	9	7	10
TOTAL DISSOLVED SOLIDS	Mg/L	29,200	30,600	29,000	29,800
TOTAL SOLIDS	Mg/L	31,800	32,100	30,000	32,500
SPECIFIC CONDUCTANCE	Micromhos/cm	43,000	43,000	42,300	43,600
TURBIDITY	JTU	9.6	7.2	4.0	6.2*
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	136	140	130	132
CHLORIDE (Cl)	Mg/L	15,800	15,500	15,800	16,000
TOTAL HARDNESS ($CaCO_3$)	Mg/L	5,260	5,300	5,200	5,200
AMMONIA NITROGEN (N)	Mg/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	Mg/L	0.83	0.89	0.90	1.09
TOTAL NITROGEN (N)	Mg/L	2.00	2.36	1.54	1.98
B.O.D., 5-DAY, 20°C	Mg/L	<1.0	<1.0	<1.0	<1.0

COMMENTS:

*Analytical Quality Control Analysis

Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN /TN Analyst

R.A. Ryder Director
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.		754953	754954	754955	754956
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005		Sta. Q	Sta. R	Sta. S	Sta. T
TREATMENT:					
DATE COLLECTED:		10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:		1115	1115	1155	1220
Analysis	**Units**	**ANALYTICAL RESULTS**			
SALINITY	$^{o}/_{oo}$	29	28	29	29
IRON (Fe) (1)	Mg/L	0.64	0.33	0.21*	0.46
CADMIUM (Cd) (1)	Mg/L	<0.005	<0.005	<0.005*	<0.005
LEAD (Pb) (1)	Mg/L	0.05	<0.01	0.07*	0.04
MERCURY (Hg) (2)	Mg/L	0.0007	0.00010	0.0007*	0.0011
ZINC (Zn) (1)	Mg/L	0.044	0.041	0.042*	0.064
REACTIVE PHOSPHOROUS (P)	Mg/L	0.60	0.60	0.60	0.55
TOTAL PHOSPHOROUS (P)	Mg/L	0.62	0.62	0.61	0.72
SILICA (SiO_2)	Mg/L	11	11	10	11
SODIUM (Na) (1)	Mg/L	8,800	8,500	7,300*	7,800
SULFATE (SO_4)	Mg/L	2,000	1,940	1,880	2,000
TOTAL COLIFORM	MPN/100ml	23	49	2	14
FECAL COLIFORM	MPN/100ml	2	2	<2	4

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer
Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN TN Analyst

R.A. Ryder
R. A. Ryder Director

(PEL 5048) Page 5 of 8

Received 10/17/75

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.		754957	754958	754959	754960
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005		Sta. U	Sta. V	Sta. W	Sta. X
TREATMENT:					
DATE COLLECTED:		10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:		1220	1220	1315	1315
Analysis	**Units**	**ANALYTICAL RESULTS**			
APPARENT COLOR	Color Unit	12	13	12*	7
TOTAL DISSOLVED SOLIDS	Mg/L	30,400	29,300	29,600	29,800
TOTAL SOLIDS	Mg/L	32,400	30,900	31,000	30,600
SPECIFIC CONDUCTANCE	Micromhos / cm	44,300	43,000	43,200	42,600
TURBIDITY	JTU	7.4	8.4	6.5	4.9
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	124	144	146	134
CHLORIDE (Cl)	Mg/L	16,000	16,000	16,000	16,000
TOTAL HARDNESS ($CaCO_3$)	Mg/L	5,300	5,200	5,200	5,250
AMMONIA NITROGEN (N)	Mg/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	Mg/L	0.83	0.97	0.96	0.99
TOTAL NITROGEN (N)	Mg/L	2.28	1.90*	1.60	1.63
B.O.D., 5-DAY, 20°C	Mg/L	<1.0	<1.0	<1.0	<1.0

COMMENTS:

*Analytical Quality Control Analysis

Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN TN Analyst

R.A. Ryder
R. A. Ryder Director

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754957	754958	754959	754960
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005	Sta. U	Sta. V	Sta. W	Sta. X
TREATMENT:				
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1220	1220	1315	1315

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	°/oo	29	29	29	29
IRON (Fe) (1)	Mg/L	0.40	0.33	0.33	0.31
CADMIUM (Cd) (1)	Mg/L	<0.005	<0.005	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.12	0.02	0.03	0.06
MERCURY (Hg) (2)	Mg/L	0.0012	0.0011	0.0017	0.0011
ZINC (Zn) (1)	Mg/L	0.033	0.099	0.023	0.110
REACTIVE PHOSPHOROUS (P)	Mg/L	0.55	0.50	0.60	0.65
TOTAL PHOSPHOROUS (P)	Mg/L	0.62	0.54	0.60	0.70
SILICA (SiO_2)	Mg/L	11	11	11	11
SODIUM (Na) (1)	Mg/L	8,000	7,500	7,800	7,000
SULFATE (SO_4)	Mg/L	1,880	2,100	1,940	1,880
TOTAL COLIFORM	MPN/100ml	11	130	**	23
FECAL COLIFORM	MPN/100ml	2	33	**	23

COMMENTS:
* Analytical Quality Control Analysis
** Sample not submitted for coliform analysis.

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer

Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN ITN Analyst

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754961	754962	754963	754964
SOURCE OF SAMPLE:	Sta. Y	Sta. Z	Sta. AA	Sta. BB
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1315	1400	1400	1400

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	10	11	13	**
TOTAL DISSOLVED SOLIDS	Mg/L	29,300	28,600	29,900	**
TOTAL SOLIDS	Mg/L	32.000	30,800	31,100	**
SPECIFIC CONDUCTANCE	Micromhos/cm	43,500	43,500	43,500	**
TURBIDITY	JTU	4.6	7.0	5.4	**
TOTAL ALKALINITY ($CaCO_3$)	Mg/L	132	132	146	**
CHLORIDE (Cl)	Mg/L	15,800	16,000	15,800*	**
TOTAL HARDNESS ($CaCO_3$)	Mg/L	5,150	5,250	5,200	**
AMMONIA NITROGEN (N)	Mg/L	<0.06*	<0.06	0.11	<0.06
NITRATE NITROGEN (N)	Mg/L	0.96	0.94	0.94	0.99
TOTAL NITROGEN (N)	Mg/L	1.89	1.86	1.87	**
B.O.D., 5-DAY, 20°C	Mg/L	<1.0	<1.0	1.0	**

COMMENTS:

*Analytical Quality Control Analysis
**Samples not submitted.
Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN ITN Analyst

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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA.

LAB NO.	754961	754962	754963	754964
SOURCE OF SAMPLE: South Bay Discharger Authority Bechtel Project 10035-005	Sta. Y	Sta. Z	Sta. AA	Sta. BB
TREATMENT:				
DATE COLLECTED:	10/17/75	10/17/75	10/17/75	10/17/75
TIME COLLECTED:	1315	1400	1400	1400

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	°/oo	29	29	29	**
IRON (Fe) (1)	Mg/L	0.27	0.45	0.34	0.22
CADMIUM (Cd) (1)	Mg/L	<0.005	<0.005	<0.005	<0.005
LEAD (Pb) (1)	Mg/L	0.04	0.17	0.06	0.07
MERCURY (Hg) (2)	Mg/L	0.0009	0.0009	0.0011	0.0011
ZINC (Zn) (1)	Mg/L	0.116	0.056	0.027	0.036
REACTIVE PHOSPHOROUS (P)	Mg/L	0.60*	0.50	0.65	**
TOTAL PHOSPHOROUS (P)	Mg/L	0.65	0.52	0.72	**
SILICA (SiO_2)	Mg/L	11	12	12	**
SODIUM (Na) (1)	Mg/L	8,500*	8,300	8,800	7,500
SULFATE (SO_4)	Mg/L	1,830	2,030*	1,950	--
TOTAL COLIFORM	MPN/100ml	33	13	70	13
FECAL COLIFORM	MPN/100ml	4	2	9	5

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold-Vapor Atomic Absorption Spectrophotometer
Samples collected and delivered by Bionomics personnel.

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TH ITA Analyst

R. A. Ryder Director
R. A. Ryder

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dep

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763484	763485	763486	763487
SOURCE OF SAMPLE:	Sta. A	Sta. B	Sta. C	Sta. D
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1714	1657	1650	1640

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	168	116*	86	122
Total Dissolved Solids	Mg/L	15,000*	22,300	27,700	27,800
Total Solids	Mg/L	16,800*	30,400	30,000	34,200
Specific Conductance	Micromhos cm	21,700	31,700*	32,800	37,500
Turbidity	JTU	39	22	21	32
Total Alkalinity ($CaCO_3$)	Mg/L	192	157	155*	132
Chloride (Cl)	Mg/L	7,600	11,000	12,300*	15,000
Total Hardness ($CaCO_3$)	Mg/L	2,700	4,300	4,400	5,200
Ammonia Nitrogen (N)	Mg/L	4.16*	1.12	1.40*	0.34
Nitrate Nitrogen (N)	Mg/L	2.88*	2.10	2.30	1.09
Total Nitrogen (N)	Mg/L	9.90*	5.70	5.57	2.69
B.O.D., 5-Day, 20°C	Mg/L	7.0	1.4	1.2	1.1

COMMENTS: *Analytical Quality Control Analysis

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T. R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TH,SDR,MH,CB Analyst
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Service Dept.

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763484	763485	763486	763487
SOURCE OF SAMPLE:	Sta A	Sta B	Sta C	Sta D
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1714	1657	1650	1640

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	14	20	22	27
Iron (Fe) (1)	Mg/L	2.05	1.44	0.96	1.28
Cadmium (Cd) (1)	Mg/L	<0.002	<0.002	<0.002	<0.002
Lead (Pb) (1)	Mg/L	0.01	0.01	0.01	< 0.01
Mercury (Hg) (2)	Mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Zinc (Zn) (1)	Mg/L	0.061	0.023	0.014	0.028
Reactive Phosphorous (P)	Mg/L	4.5	2.7*	2.5	1.6
Total Phosphorous (P)	Mg/L	4.5	2.8	4.0	2.8
Silica (SiO_2)	Mg/L	14	15	14	12
Sodium (Na) (1)	Mg/L	6,500	7,500	7,000	8,500
Sulfate (SO_4)	Mg/L	1,000*	1,700	1,800	2,100
Total Coliform	MPN/100ml	790	330	130	79
Fecal Coliform	MPN/100ml	460	43	130	8

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer
Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation **REPORT TO** Dr. C. H. Harper, Env. Services Dep

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763488	763489	763490	763491
SOURCE OF SAMPLE:	Sta E	Sta F	Sta G	Sta H
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1625	1612	1555	1515

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	136	96	38	62
Total Dissolved Solids	Mg/L	24,000	27,700	29,400	29,500
Total Solids	Mg/L	27,100	32,300	36,000	33,900
Specific Conductance	Micromhos cm	32,800	37,500	37,500	38,800
Turbidity	JTU	36	28*	8.6	17
Total Alkalinity ($CaCO_3$)	Mg/L	152	135	127	126
Chloride (Cl)	Mg/L	13,000	15,500	16,000	16,300
Total Hardness ($CaCO_3$)	Mg/L	4,400*	5,200	5,500	5,500
Ammonia Nitrogen (N)	Mg/L	1.01	0.45	0.22	0.50
Nitrate Nitrogen (N)	Mg/L	1.90	1.18	0.77	0.80
Total Nitrogen (N)	Mg/L	4.89	2.59	1.72	2.89
B.O.D., 5-Day, 20°C	Mg/L	2.7	1.5	1.5	2.2

COMMENTS: *Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN,SDR,NH,CB Analyst
DDKennedy for Director
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PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation **REPORT TO** Dr. C. H. Harper, Env. Services Dept

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763488	763489	763490	763491
SOURCE OF SAMPLE:	Sta E	Sta F	Sta G	Sta H
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1625	1612	1555	1515

Collected & Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	23	27	28	29
Iron (Fe) (1)	Mg/L	1.40	1.24*	0.40	0.88
Cadmium (Cd) (1)	Mg/L	<0.002	<0.002*	<0.002	<0.002
Lead (Pb) (1)	Mg/L	0.01	0.07*	0.01	0.01
Mercury (Hg) (2)	Mg/L	<0.0002	<0.0002	<0.0002*	<0.0002
Zinc (Zn) (1)	Mg/L	0.078	0.018*	0.008	0.006
Reactive Phosphorous (P)	Mg/L	2.5	2.2	1.3	1.3
Total Phosphorous (P)	Mg/L	2.5	2.2	1.4*	1.3
Silica (SiO_2)	Mg/L	13	12	10	11
Sodium (Na) (1)	Mg/L	7,500	9,100	9,500	9,500
Sulfate (SO_4)	Mg/L	1,800	2,100	2,300	2,300
Total Coliform	MPN/100ml	230	230	17	13
Fecal Coliform	MPN/100ml	130	23	11	2

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Swawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dep

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763492	763493	763494	763495
SOURCE OF SAMPLE:	Sta I	Sta J	Sta K	Sta L
South Bay Dischargers Authroity Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1500	1305	1310	1315

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	60	20	20	20
Total Dissolved Solids	Mg/L	30,700	31,500	31,000	30,800
Total Solids	Mg/L	35,200	36,600	37,900	37,000
Specific Conductance	Micromhos cm	39,900	39,900	42,200	39,900
Turbidity	JTU	17	3.6	4.9	5.1
Total Alkalinity ($CaCO_3$)	Mg/L	122	116	115	113
Chloride (Cl)	Mg/L	17,200	17,500	18,000	17,500
Total Hardness ($CaCO_3$)	Mg/L	5,600	5,900	5,900	5,800
Ammonia Nitrogen (N)	Mg/L	0.11*	<0.06	<0.06	<0.06
Nitrate Nitrogen (N)	Mg/L	0.59	0.10*	0.14	0.10
Total Nitrogen (N)	Mg/L	1.78*	0.40	0.39	0.11
B.O.D., 5-Day 20°C	Mg/L	1.6	<1.0	1.4	1.1

COMMENTS: *Analytical Quality Control Analysis

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dept

ADDRESS P.O. Box 3965, San Francisco, California

LAB NO.	763492	763493	763494	763495
SOURCE OF SAMPLE:	Sta I	Sta J	Sta K	Sta L
South Bay Dischargers Authority				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1500	1305	1310	1315

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	30	31	32	31
Iron (Fe) (1)	Mg/L	1.05	0.19	0.21	0.33
Cadmium (Cd) (1)	Mg/L	<0.002	<0.002	<0.002	<0.002
Lead (Pb) (1)	Mg/L	0.01	0.01	0.02	<0.01
Mercury (Hg) (2)	Mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Zinc (Zn) (1)	Mg/L	0.027	0.028	0.033	0.032
Reactive Phosphorous (P)	Mg/L	1.1	0.50	0.50*	0.47
Total Phosphorous (P)	Mg/L	1.1	0.55	0.50	0.57
Silica ($SiSO_2$)	Mg/L	8.5	6.0	5.0	5.5
Sodium (Na) (1)	Mg/L	11,500	12,000	10,500	9,500
Sulfate (SO_4)	Mg/L	2,200	2,100	2,100	2,100
Total Coliform	MPN/100ml	17	2*	5	49
Fecal Coliform	MPN/100ml	<2	<2*	<2	4

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer
Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dep

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763496	763497	763498	763499
SOURCE OF SAMPLE:	Sta M	Sta N	Sta O	Sta P
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1025	1050	1055	1200

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	39*	28	26	22
Total Dissolved Solids	Mg/L	31,400	31,900	32,000*	30,100
Total Solids	Mg/L	34,500	34,900	34,700*	34,400
Specific Conductance	Micromhos cm	39,900*	39,900	39,900	39,500
Turbidity	JTU	9.8	6.5	4.8	4.4*
Total Alkalinity ($CaCO_3$)	Mg/L	116	117*	116	112
Chloride (Cl)	Mg/L	17,500	17,000	17,000	17,500
Total Hardness ($CaCO_3$)	Mg/L	5,900*	5,900	5,900	5,800
Ammonia Nitrogen (N)	Mg/L	<0.06	≤0.06	<0.06	<0.06
Nitrate Nitrogen (N)	Mg/L	0.14	0.33	0.23	0.09
Total Nitrogen (N)	Mg/L	0.44	0.63	0.82	0.10
B.O.D., 5-Day, 20°C	Mg/L	<1.0	≤1.0	1.0	<1.0

COMMENTS: *Analytical Quality Control Analysis

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN,SDR,MH,CB Analyst

DDKennedy for Director
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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dept.

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763496	763497	763498	763499
SOURCE OF SAMPLE:	Sta M	Sta N	Sta O	Sta P
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1025	1050	1055	1200

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	31	30	30	31
Iron (Fe) (1)	Mg/L	0.43	0.33	0.29	0.24
Cadmium (Cd) (1)	Mg/L	≤0.002	≤0.002	≤0.002	<0.002
Lead (Pb) (1)	Mg/L	0.01	<0.01	<0.01	≤0.01
Mercury (Hg) (2)	Mg/L	<0.0002	≤0.0002	<0.0002	<0.0002
Zinc (Zn) (1)	Mg/L	0.048	0.030	0.008	0.01
Reactive Phospherous (P)	Mg/L	0.55	0.61	0.65	0.45
Total Phosphorous (P)	Mg/L	0.55	0.61	0.65*	0.45
Silica (SiO_2)	Mg/L	6.0	6.0	6.2	5.0
Sodium (Na) (1)	Mg/L	11,000	9,500	9,000	10,000
Sulfate (SO_4)	Mg/L	2,100	2,100	2,100	2,100
Total Coliform	MPN/100ml	49	≤2	≤2	9
Fecal Coliform	MPN/100ml	13	<2	<2	4

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic-Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T. R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

TN,SDR,MH,CB Analyst

DDKennedy for Director
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 7/8/76
Reported 8/9/76
Corrected 9/1/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dep

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763500	763501	763502	763503
SOURCE OF SAMPLE:	Sta Q	Sta R	Sta S	Sta T
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1205	1210	1130	1225

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	16	18	26	16
Total Dissolved Solids	Mg/L	30,600	30,700	30,400	30,900
Total Solids	Mg/L	35,200	36,200 (1)	35,900 (1)	37,700 (1)
Specific Conductance	Micromhos / cm	39,500	39,500	39,900	39,500
Turbidity	JTU	3.6	3.9	5.7	3.9
Total Alkalinity ($CaCO_3$)	Mg/L	113	116	120	115
Chloride (Cl)	Mg/L	17,500	17,000	17,000	17,000
Total Hardness ($CaCO_3$)	Mg/L	5,900*	5,600	5,800	5,900
Ammonia Nitrogen (N)	Mg/L	<0.06	<0.06	0.11	<0.06
Nitrate Nitrogen (N)	Mg/L	0.16	0.25	0.39	0.15
Total Nitrogen (N)	Mg/L	0.17	0.28	1.00	0.17
B.O.D., 5-Day, 20°C	Mg/L	≤1.0	1.4	1.6	1.0

COMMENTS: *Analytical Quality Control Analysis (1) Corrected value

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register, Vol 40, No. 111, 9 June, 1975

TN,SDR,NH,CB TN Analyst
R.A. Ryder Director
R. A. Ryder

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PHONE - (415) 495 - 6627

Received 7/8/76
Reported 8/9/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Services Dept.

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763500	763501	763502	763503
SOURCE OF SAMPLE:	Sta Q	Sta R	Sta S	Sta T
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1205	1210	1130	1225

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	31	30	30	30
Iron (Fe) (1)	Mg/L	0.22	0.21*	0.31	0.20
Cadmium (Cd) (1)	Mg/L	≤0.002	≤0.002*	<0.002	≤0.002
Lead (Pb) (1)	Mg/L	0.01	0.01*	0.01	≤0.01
Mercury (Hg) (2)	Mg/L	≤0.0002*	≤0.0002	≤0.0002	≤0.0002
Zinc (Zn) (1)	Mg/L	0.016	0.023*	0.027	0.012
Reactive Phosphorous (P)	Mg/L	0.45	0.65	0.79	0.54
Total Phosphorous (P)	Mg/L	0.45	0.65	0.79	0.61
Silica (SiO_2)	Mg/L	5.0	6.4	7.2	5.4
Sodium (Na) (1)	Mg/L	9,500	10,500*	10,500	10,500
Sulfate (SO_4)	Mg/L	2,100*	2,100	2,000	2,000
Total Coliform	MPN/100ml	70	79	5	2*
Fecal Coliform	MPN/100ml	<2	<2	5	<2*

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer
Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T. R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register. Vol 40, No. 111, 9 June, 1975

TN,SDR,NH,CB Analyst
DD Kennedy for Director
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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6827

Received 7/8/76
Reported 8/9/76
Corrected 9/1/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept.
ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763504	763505	763506	763507
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	Sta U	Sta V	Sta W	Sta X
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1230	1235	1440	1435

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	16	16	18	16*
Total Dissolved Solids	Mg/L	31,700	31,100	30,700	30,400
Total Solids	Mg/L	37,300 (1)	36,600 (1)	35,700	35,600
Specific Conductance	Micromhos cm	39,900	39,900	39,500	41,100*
Turbidity	JTU	4.5	4.9	3.9	4.6
Total Alkalinity ($CaCO_3$)	Mg/L	116	114	117	118
Chloride (Cl)	Mg/L	17,500	17,500	17,500*	17,500
Total Hardness ($CaCO_3$)	Mg/L	5,900	5,900	5,900	5,900
Ammonia Nitrogen (N)	Mg/L	≤0.06	≤0.06	0.11	≤0.06
Nitrate Nitrogen (N)	Mg/L	0.09	0.08	0.22	0.26
Total Nitrogen (N)	Mg/L	0.10	0.37	1.08	0.85
B.O.D., 5-Day, 20°C	Mg/L	1.2	1.0	1.8	2.0

COMMENTS: *Analytical Quality Control Analysis (1) Corrected value

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures. Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept.
ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763504	763505	763506	763507
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	Sta U	Sta V	Sta W	Sta X
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1230	1235	1440	1435

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/o o	31	31	31	31
Iron (Fe) (1)	Mg/L	0.28	0.27	0.24	0.19
Cadmium (Cd) (1)	Mg/L	≤0.002	≤0.002	≤0.002	≤0.002
Lead (Pb) (1)	Mg/L	0.01	0.01	≤0.01	0.01
Mercury (Hg) (2)	Mg/L	≤0.0002	≤0.0002	≤0.0002	≤0.0002
Zinc (Zn) (1)	Mg/L	0.038	0.047	0.021	0.009
Reactive Phosphorous (P)	Mg/L	0.49	0.44	0.64	0.68
Total Phosphorous (P)	Mg/L	0.55	0.49	0.65	0.85
Silica (SiO_2)	Mg/L	4.8	5.0	6.2	6.6
Sodium (Na) (1)	Mg/L	10,500	10,500	11,500	10,300*
Sulfate (SO)	Mg/L	2,100	2,100	2,200	2,000
Total Coliform	MPN/100ml	7	17	5	17
Fecal Colifrom	MPN/100ml	≤2	5	2	5

COMMENTS:
(1)Analysis by Atomic Absorption Spectrophotometer (2)Analysis by Cold Vapor Atomic Absorption Spectrophotometer *Corrected value

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept

ADDRESS P.O. Box 3965, San Francisco, California

LAB NO.	763508	763509	763510	763511
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtwl Project 10035-005	Sta Y	Sta Z	Sta ZZ	Sta BB
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1430	1355	1350	1345

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	16	20	18	26
Total Dissolved Solids	Mg/L	31,100	31,000	30,700 (1)	30,600*
Total Solids	Mg/L	35,400	35,800	35,800	35,500
Specific Conductance	Micromhos cm	41,600	42,800	42,200	42,200
Turbidity	JTU	3.4*	6.1	7.4	6.6
Total Alkalinity (CaCO$_3$)	Mg/L	117	115*	116	115
Chloride (Cl)	Mg/L	17,500	17,500	17,500	17,500
Total Hardness (CaCO$_3$)	Mg/L	5,900	5,900	5,900	5,900
Ammonia Nitrogen (N)	Mg/L	<0.06	<0.06	0.06	≤0.06
Nitrate Nitrogen (N)	Mg/L	0.29	0.13	0.22*	0.30
Total Nitrogen (N)	Mg/L	0.32	0.71	0.80	1.16
B.O.D., 5-Day, 20°C	Mg/L	1.5	1.6	2.0	1.9

COMMENTS: *Analytical Quality Control Analysis (1) Corrected value

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

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WASTEWATER ANALYSIS REPORT

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ADDRESS P. O. Box 3965, San Francisco, California

LAB NO.	763508	763509	763510	763511
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	Sta Y	Sta Z	Sta AA	Sta BB
TREATMENT:				
DATE COLLECTED:	7/8/76	7/8/76	7/8/76	7/8/76
TIME COLLECTED:	1430	1355	1350	1345

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/o o	31	31	31	31
Iron (Fe) (1)	Mg/L	0.19	0.29	0.41	0.41*
Cadmium (Cd) (1)	Mg/L	≤0.002	≤0.002	≤0.002	≤0.002*
Lead (Pb) (1)	Mg/L	≤0.01	≤0.01	≤0.01	0.01*
Mercury (Hg) (2)	Mg/L	≤0.0002	≤0.0002*	≤0.0002	≤0.0002
Zinc (Zn) (1)	Mg/L	0.008	0.015	0.019	0.024*
Reactive Phosphorous (P)	Mg/L	0.68*	0.52	0.64	0.62
Total Phosphorous (P)	Mg/L	0.78	0.54	0.67	0.62*
Silica (SiO$_2$)	Mg/L	6.4	5.8	6.3	6.0
Sodium (Na) (1)	Mg/L	10,600 (1)	11,400 (1)	11,300 (1)	11,000*
Sulfate (SO$_4$)	Mg/L	2,100	2,100	2,100	2,100
Total Coliform	MPN/100ml	27	2	2	63
Fecal Coliform	MPN/100ml	< 2	2	< 2	2

COMMENTS:
*Analytical Quality Control Analysis (1) Analysis by Atomic Absorption Spectrophotometer (2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer (1) Corrected value

Analytical Method: (a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept

ADDRESS P. O. Box 3965, San Francisco, California

LAB NO. 763512

SOURCE OF SAMPLE: Sta CC
South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 7/8/76

TIME COLLECTED: 1540

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	140			
Total Dissolved Solids	Mg/L	28,900 (1)			
Total Solids	Mg/L	33,800*			
Specific Conductance	Micromhos cm	39,500			
Turbidity	JTU	50			
Tocal Alkalinity ($CaCO_3$)	Mg/L	129			
Chloride (Cl)	Mg/L	17,000			
Total Hardness ($CaCO_3$)	Mg/L	5,600			
Ammonia Nitrogen (N)	Mg/L	≤0.06*			
Nitrate Nitrogen (N)	Mg/L	1.50			
Total Nitrogen (N)	Mg/L	2.94*			
B.O.D., 5-Day, 20°C	Mg/L	2.3			

COMMENTS: *Analytical Quality Control Analysis (1) Corrected value

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T.R. Parsons

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures." Federal Register, Vol 40, No. 111, 9 June, 1975

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657 Howard Street, San Francisco 94105
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Received 7/8/76
Reported 8/9/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. M. Harper, Env. Service Dept.

ADDRESS P. O. Box 3965, San Francisco California

LAB NO. 763512

SOURCE OF SAMPLE: Sta CC

South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 7/8/76

TIME COLLECTED: 1540

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	o/oo	30			
Iron (Fe) (1)	Mg/L	3.7			
Cadmium (Cd) (1)	Mg/L	<0.002			
Lead (Pb) (1)	Mg/L	0.01			
Mercury (Hg) (2)	Mg/L	<0.0002			
Zinc (Zn) (1)	Mg/L	0.051			
Reactive Phosphorous (P)	Mg/L	1.3			
Total Phosphorous (P)	Mg/L	1.5			
Silica (SiO_2)	Mg/L	9.6			
Sodium (Na) (1)	Mg/L	9,500			
Sulfate (SO_4)	Mg/L	2,200			
Total Coliform	MPN/100ml	63*			
Fecal Coliform	MPN/100ml	<2*			

COMMENTS:
*Analytical Quality Control Analysis. A report on range of values, standard deviations, and percent recovery of analytical quality control samples will be submitted later.
(1)Analysis by Atomic Absorption Spectrophotometer. (2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer
Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Ed., APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T. R. Parsons

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TN,SDR,NH,CB Analyst

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Received 7/8/76
Reported 9/1/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dep

ADDRESS P.O. Box 3965, San Francisco, California 94119

LAB NO. 763484 through 763512

SOURCE OF SAMPLE: South Bay Water Samples
South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 7/8/76

TIME COLLECTED:

Collected & Delivered by: E. Smith & D. Williams

Analysis	Units	Date of Analysis			Analytical Method
Apparent Color	Color Unit	7/9/76			SM (1)
Total Dissolved Solids	Mg/L	7/9-12/76			EPA (2)
Total Solids	Mg/L	7/12-14/76			EPA (2)
Specific Conductance	Micromhos cm	7/9/76			SM (1)
Turbidity	JTU	7/9/76			SM (1)
Total Alkalinity ($CaCO_3$)	Mg/L	7/9/76			SM (1)
Chloride (Cl)	Mg/L	7/9-13/76			SM (1)
Total Hardness ($CaCO_3$)	Mg/L	7/26-27/76			SM (1)
Ammonia Nitrogen (N)	Mg/L	7/9/76			EPA (2)
Nitrate Nitrogen (N)	Mg/L	7/9/76			SM (2)
Total Nitrogen (N)	Mg/L	7/9/76			SM (2)
B.O.D., 5-Day, 20°C	Mg/L	7/9/76*			SM (2)

COMMENTS: *Since the samples were not received until 8:20 p.m. on 7/8/76, the incubation o B.O.D. sample were started on 7/9/76 after overnight refrigeration.

Analytical Methods

(1) "Standards for the Methods for the Examination of Water and Wastewater" 13th Edition, APHA

(2) "Manual of Methods for Chemical Analysis of Water and Wastes", 1974, EPA

(3) "A Practical Handbook of Seawater Analysis"
J.D.H. Strickland, T.R. Parson

TN, SDR, NH / TN Analyst
R.A. Ryder Director
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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 7/8/76
Reported 9/1/76

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept.

ADDRESS P.O. Box 3965, San Francisco, California 94119

LAB NO. 763484 through 763512

SOURCE OF SAMPLE: South Bay Water Samples
South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 7/8/76

TIME COLLECTED:

Collected & Delivered by: E. Smith & D. Williams

Analysis	Units	Date of Analysis			Analytical Method
Salinity	o/o o	7/9-13/76			Strickland (3)
Iron (Fe)	Mg/L	7/12-20/76			EPA (2)
Cadmium (Cd)	Mg/L	7/12-20/76			EPA (2)
Lead (Pb)	Mg/L	7/12-20/76			EPA (2)
Mercury (Hg)	Mg/L	7/12-20/76			EPA (2)
Zinc (Zn)	Mg/L	7/12-20/76			EPA (2)
Reactive Phosphorous (P)	Mg/L	7/9/76			EPA (2)
Total Phosphorous (P)	Mg/L	7/9-12/76			EPA (2)
Silica (SiO_2)	Mg/L	7/20-23/76			SM (1)
Sodium (Na)	Mg/L	7/12-20/76			EPA (2)
Sulfate (SO_4)	Mg/L	7/14-21/76			SM (1)
Total & Fecal Coliform	MPN/100ml	Date of receiving*			SM (1)

COMMENTS: *Samples were received at 8:20 p.m. on 7/8/76 and incubation for coliform were started between 8:35 p.m. and 9:45 p.m.

Analytical Methods

(1) "Standards for the Methods for the Examination of Water and Wastewater" 13th Edition, APHA

(2) "Manual of Methods for Chemical Analysis of Water and Wastes", 1974, EPA

(3) "A Practical Handbook of Seawater Analysis
J.D.H. Strickland, T.R. Parson

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R. A. Ryder

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Received 7/8/76

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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept

ADDRESS P.O. Box 3965, San Francisco, California 94119

LAB NO.	763484	through	763512	
SOURCE OF SAMPLE: South Bay Dischargers Authority Bechtel Project 10035-005	South Bay	Water Samples		
TREATMENT:				
DATE COLLECTED:	7/8/76			
TIME COLLECTED:				

Collected & Delivered by: E. Smith & D. Williams

ANALYTICAL QUALITY ASSURANCE DATA

To assure reliability and accuracy of the Analytical methods used, an Analytical Quality Control Program is routinely practiced in this laboratory. The Analytical Quality Control data developed pertinent to analysis of South Bay water samples collected on 7/8/76 for the South Bay Dischargers Authority, Bechtel Project 10035-005 are summarized herein.

Summary of Analytical Quality Control Analysis Data

Parameter	No. of Samples Analyzed	Range, Conc.	Range Std. Dev. S	Range, Spike Recovery, %
Apparent Color	3	16-116 Color Unit	2-5	—
T. Diss. Solids	3	15,000-32,000 Mg/L	170-240	—
Total Solids	3	16,800-34,700 Mg/L	200-660	—
Spec. Conductance	3	31,700-41,000 µmhos/cm	390-620	—
Turbidity	3	3.4-28 JTU	0.0-0.1	—
T. Alkalinity	3	115-155 Mg/L	1.0-1.1	—
Chloride	3	12,300-17,500 Mg/L	100-200	97-104
T. Hardness	3	4,400-5,900 Mg/L	50	100 (1)
Ammonia Nitrogen	3	0.11-4.16 Mg/L	0.01-0.05	90-106
T. Kjeld. Nitrogen	3	1.12-6.32 Mg/L	0.14-0.23	95-103
Nitrate Nitrogen	3	0.10-2.88	0.02-0.19	90
Iron	3	0.21-1.24 Mg/L	0.02-0,05	95 (1)
Cadmium	3	<0.002 Mg/L	—	102 (1)
Lead	3	0.01-0.02 Mg/L	—	100 (1)
Mercury	3	<0.0002 Mg/L	—	75 (1)
Zinc	3	0.018-0.024 Mg/L	—	100 (1)
React. Phosphorous	3	0.50-2.7 Mg/L	0.1	103 (1)
T. Phosphorous	3	0.62-1.40 Mg/L	0.01-0.12	100 (1)
Silica	3	5.5-12.0 Mg/L	0.1-0.5	—
Sodium	3	9,100-11,000 Mg/L	500-600	100 (1)
Sulfate	3	1,000-2,300 Mg/L	19-70	100 (1)

COMMENTS: (1) Based on a single sample.

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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV.SERVICES DEP

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.		761003	761004	761005	761006
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005		Sta A	Sta B	Sta C	Sta D
TREATMENT:					
DATE COLLECTED:		3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED:	Grab:	1305	1315	1325	1335

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	32	32	36*	32
TOTAL DISSOLVED SOLIDS	MG/L	22,900*	23,600	21,100	24,100
TOTAL SOLIDS	MG/L	25,500*	26,000	25,600	25,800
SPECIFIC CONDUCTANCE	Micromhos/cm	30,000	31,000	32,000	33,000
TURBIDITY	JTU	14*	12	10	9
TOTAL ALKALINITY ($CaCO_3$)	MG/L	128	124	127*	122
CHLORIDE (Cl)	MG/L	12,900*	12,800	12,800	13,800
TOTAL HARDNESS ($CaCO_3$)	MG/L	4,200	4,400	4,400	4,500*
AMMONIA NITROGEN (N)	MG/L	0.22	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.65	0.68*	0.65	0.51
TOTAL NITROGEN (N)	MG/L	1.43	2.84	2.82	2.34
B.O.D.,5-DAY,20°C	MG/L	8.3	8.7	8.7	9.1

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,NH,CB /TN Analyst

R.A. Ryder Director
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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER,ENV.SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.		761003	761004	761005	761006
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005		Sta A	Sta B	Sta C	Sta D
TREATMENT:					
DATE COLLECTED:		3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED:	Grab:	1305	1315	1325	1335

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	23	23	23	25
IRON (Fe)(1)	MG/L	0.90	0.70	0.51	0.34
CADMIUM (Cd)(1)	MG/L	<0.002	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	0.01	<0.01	<0.01	0.01
MERCURY (Hg)(2)	MG/L	0.0010	0.0002	<0.0002	<0.0002
ZINC (Zn)(1)	MG/L	0.045	0.075	0.019	0.015
REACTIVE PHOSPHOROUS (P)	MG/L	0.92	0.81*	0.80	0.74
TOTAL PHOSPHOROUS (P)	MG/L	1.44	1.06*	1.04	0.84
SILICA (SiO_2)	MG/L	6.2*	5.8*	5.4	4.2
SODIUM (Na) (1)	MG/L	7,700	7,400	8,000	7,800
SULFATE (SO_4)	MG/L	1,600	1,600	1,500	1,600*
TOTAL COLIFORM	MPN/100 ml	79	49	130	14
FECAL COLIFORM	MPN/100 ml	49	33	130	14

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV.SERVICES DEP

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.		761007	761008	761009	761000
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005		Sta E	Sta F	Sta G	Sta H
TREATMENT:					
DATE COLLECTED:		3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED:	Grab:	1345	1355	1405	1415

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	36	31	30*	31
TOTAL DISSOLVED SOLIDS	MG/L	22,000	23,500	24,600	24,200
TOTAL SOLIDS	MG/L	23,800	26,200	25,800	26,700
SPECIFIC CONDUCTANCE	Micromhos/cm	30,000	32,000	35,000	35,000
TURBIDITY	JTU	9	8	8	8
TOTAL ALKALINITY ($CaCO_3$)	MG/L	130	126	118	120
CHLORIDE (Cl)	MG/L	12,500	13,500	13,800	13,800
TOTAL HARDNESS ($CaCO_3$)	MG/L	4,300	4,500	4,600	4,600
AMMONIA NITROGEN (N)	MG/L	0.17	0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.67	0.50	0.44	0.54
TOTAL NITROGEN (N)	MG/L	3.42	2.07	1.95	2.62
B.O.D.,5-DAY,20°C	MG/L	11	8.9	9.2	9.4

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.	761007	761008	761009	761010
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta E	Sta F	Sta G	Sta H
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1345	1355	1405	1415

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	23	24	25	25
IRON (Fe) (1)	MG/L	0.48*	0.32	0.30	C.26
CADMIUM (Cd)(1)	MG/L	<0.002*	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	0.01*	0.02	<0.01	<0.01
MERCURY (Hg) (2)	MG/L	<0.0002*	0.0002	<0.0002	<0.0002
ZINC (Zn) (1)	MG/L	0.016*	0.081	0.074	0.014
REACTIVE PHOSPHOROUS (P)	MG/L	0.98	0.80	0.70	0.[illegible]
TOTAL PHOSPHOROUS (P)	MG/L	1.20	1.02	0.82	0.88
SILICA (SiO_2)	MG/L	6.6	4.8	3.6	3.8
SODIUM (Na) (1)	MG/L	7,200	8,000	7,700	8,200
SULFATE (SO_4)	MG/L	1,500	1,600	1,600	1,600
TOTAL COLIFORM	MPN/100 ml	130	33	13	33
FECAL COLIFORM	MPN/100 ml	79	33	13	33

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	761011	761012	761013	761014
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta I	Sta J	Sta K	Sta L
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1425	1155	1155	1155

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	31	30	38	41
TOTAL DISSOLVED SOLIDS	MG/L	23,700	27,100*	24,800	25,500
TOTAL SOLIDS	MG/L	29,400	29,600*	29,000	29,400
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000	36,000	36,000	37,000
TURBIDITY	JTU	9	10	13	16
TOTAL ALKALINITY ($CaCO_3$)	MG/L	114	112	112	114
CHLORIDE (Cl)	MG/L	14,800	15,300	15,500	15,800
TOTAL HARDNESS ($CaCO_3$)	MG/L	4,900	4,900	5,000	5,000
AMMONIA NITROGEN (N)	MG/L	0.06	0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.34*	0.31	0.27	0.28
TOTAL NITROGEN (N)	MG/L	1.79	1.47	1.15	0.59
B.O.D.,5-DAY,20°C	MG/L	7.1	6.4	5.7	5.8

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.	761011	761012	761013	761014
SOURCE OF SAMPLE:	Sta I	Sta J	Sta K	Sta L
SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005				
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1425	1155	1155	1155

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	27	28	28	29
IRON (Fe) (1)	MG/L	0.49	0.52	0.68	1.40
CADMIUM (Cd) (1)	MG/L	<0.002	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	0.01	<0.01	0.01	0.01
MERCURY (Hg) (2)	MG/L	<0.0002	<0.0002	<0.0002	<0.0002
ZINC (Zn) (1)	MG/L	0.012	0.062	0.070	0.029
REACTIVE PHOSPHOROUS (P)	MG/L	0.47*	0.43	0.40	0.40
TOTAL PHOSPHOROUS (P)	MG/L	0.55*	0.56	0.50	0.47
SILICA (SiO_2)	MG/L	2.2	2.0	1.4	1.6
SODIUM (Na) (1)	MG/L	7,300	7,800	7,800	7,300
SULFATE (SO_4)	MG/L	1,800	1,800	1,900	1,800*
TOTAL COLIFORM	MPN/100 ml	8	31*	13	49
FECAL COLIFORM	MPN/100 ml	5	5*	<2	2

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV. SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	761015	761016	761017	761018
SOURCE OF SAMPLE:	Sta M	Sta N	Sta O	Sta P
SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005				
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	0915	0915	0915	1025

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	59	58	50	28
TOTAL DISSOLVED SOLIDS	MG/L	25,000	27,400	26,400	26,000
TOTAL SOLIDS	MG/L	30,500	30,600	30,800	29,300
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000	36,000	36,000	35,000
TURBIDITY	JTU	19*	19	19	9
TOTAL ALKALINITY ($CaCO_3$)	MG/L	117*	116	118	120
CHLORIDE (Cl)	MG/L	14,800	15,300	14,800	14,800
TOTAL HARDNESS ($CaCO_3$)	MG/L	5,000	5,000	5,100	4,800*
AMMONIA NITROGEN (N)	MG/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.25	0.29	0.32	0.33
TOTAL NITROGEN (N)	MG/L	0.58	1.18	1.20	1.51
B.O.D., 5-DAY, 20°C	MG/L	8.9	7.4	8.0	8.2

COMMENTS: *Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.		761015	761016	761017	761018
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005		Sta M	Sta N	Sta O	Sta P
TREATMENT:					
DATE COLLECTED:		3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED:	Grab:	0915	0915	0815	1025

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	27	28	27	27
IRON (Fe) (1)	MG/L	1.75*	1.32	1.38	0.54
CADMIUM (Cd) (1)	MG/L	<0.002*	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	<0.01*	0.02	0.01	<0.01
MERCURY (Hg) (2)	MG/L	<0.0002*	<0.0002	0.0004	<0.0002
ZINC (Zn) (1)	MG/L	0.012*	0.056	0.054	0.043
REACTIVE PHOSPHOROUS (P)	MG/L	0.48	0.45	0.42	0.52
TOTAL PHOSPHOROUS (P)	MG/L	0.58	0.56	0.48	0.60
SILICA (SiO_2)	MG/L	1.6	2.0	1.4	1.9*
SODIUM (Na) (1)	MG/L	8,400	7,700	8,300	8,300
SULFATE (SO_4)	MG/L	1,700	1,800	1,700	1,700
TOTAL COLIFORM	MPN/100 ml	33	23	33	5
FECAL COLIFORM	MPN/100 ml	33	7	33	5

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV.SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.		761019	761020	761021	761022
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005		Sta Q	Sta R	Sta S	Sta T
TREATMENT:					
DATE COLLECTED:		3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED:	Grab:	1025	1025	1015	1100

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	55	92	31	27
TOTAL DISSOLVED SOLIDS	MG/L	26,400	25,500	26,300*	24,400
TOTAL SOLIDS	MG/L	29,900	31,100	30,800*	29,400
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000	36,000	35,000	33,000
TURBIDITY	JTU	20	33	11	10
TOTAL ALKALINITY ($CaCO_3$)	MG/L	116	116	118	120
CHLORIDE (Cl)	MG/L	15,000	15,300	14,800	13,800
TOTAL HARDNESS ($CaCO_3$)	MG/L	5,000	5,000	4,800	4,700
AMMONIA NITROGEN (N)	MG/L	<0.06	<0.06	0.11	<0.06
NITRATE NITROGEN (N)	MG/L	0.32	0.40	0.28	0.28
TOTAL NITROGEN (N)	MG/L	1.49	0.69	1.19	1.47
B.O.D., 5-DAY, 20°C	MG/L	7.7	7.5	9.2	10

COMMENTS: *Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,NH,CB /TN Analyst

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER,ENV.SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.	761019	761020	761021	761022
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta O	Sta R	Sta S	Sta T
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1025	1025	1015	1100

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	27	28	28	25
IRON (Fe)(1)	MG/L	1.02	1.86	0.58*	0.51
CADMIUM (Cd)(1)	MG/L	<0.002	<0.002	<0.002*	<0.002
LEAD (Pb) (1)	MG/L	<0.01	0.02	0.01*	0.01
MERCURY (Hg)(2)	MG/L	<0.0002	<0.0002	<0.0002*	0.0008
ZINC (Zn) (1)	MG/L	0.021	0.033	0.016*	0.030
REACTIVE PHOSPHOROUS (P)	MG/L	0.45	0.44	0.53	0.49
TOTAL PHOSPHOROUS (P)	MG/L	0.58	0.58	0.64	0.68*
SILICA (SiO_2)	MG/L	1.4	1.2	2.4	3.0
SODIUM (Na) (1)	MG/L	8,100	7,600	8,500	7,800
SULFATE (SO_4)	MG/L	1,800	1,700	1,700	1,700
TOTAL COLIFORM	MPN/100 ml	17	23	49	16*
FECAL COLIFORM	MPN/100 ml	13	5	23	16*

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,MH,CB /TN Analyst

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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
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Received 3/16/76
Reported 5/6/76

WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV.SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	761023	761024	761025	761026
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta U	Sta V	Sta W	Sta X
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1100	1100	1220	1220

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	61	65	28	34
TOTAL DISSOLVED SOLIDS	MG/L	25,800	26,800	26,200	26,900
TOTAL SOLIDS	MG/L	31,400	30,200	30,000	31,400
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000	36,000	36,000	35,000
TURBIDITY	JTU	28	28	10	14
TOTAL ALKALINITY ($CaCO_3$)	MG/L	116	114	117*	114
CHLORIDE (Cl)	MG/L	14,800	14,500	14,500	14,700*
TOTAL HARDNESS ($CaCO_3$)	MG/L	5,000	5,000	5,000	4,900
AMMONIA NITROGEN (N)	MG/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.18	0.21	0.21	0.15
TOTAL NITROGEN (N)	MG/L	0.76	0.51	0.82	0.75
B.O.D.,5-DAY,20°C	MG/L	7.3	7.0	7.1	6.5

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,MH,CB /TN Analyst

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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV.SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.	761023	761024	761025	761026
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta U	Sta V	Sta W	Sta X
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1100	1100	1220	1220

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	28	26	26	27
IRON (Fe)(1)	MG/L	0.51	2.60	0.59	0.94
CADMIUM (Cd) (1)	MG/L	<0.002	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	0.01	<0.01	0.01	<0.01
MERCURY (Hg)(2)	MG/L	<0.0002	0.0002	0.0006	0.0002
ZINC (Zn) (1)	MG/L	0.019	0.023	0.024	0.031
REACTIVE PHOSPHOROUS (P)	MG/L	0.47	0.41	0.47	0.42
TOTAL PHOSPHOROUS (P)	MG/L	0.47	0.48	0.51	0.49
SILICA (SiO_2)	MG/L	3.0	3.2	2.8	2.8*
SODIUM (Na) (1)	MG/L	8,200	8,200	7,900	8,200
SULFATE (SO_4)	MG/L	1,800	1,700	1,800	1,800*
TOTAL COLIFORM	MPN/100 ml	2	8	8	8
FECAL COLIFORM	MPN/100 ml	2	2	2	5

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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R.A. Ryder Director
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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C. M. HARPER, ENV.SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	761027	761028	761029	761030
SOURCE OF SAMPLE: SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005	Sta Y	Sta Z	Sta AA	Sta BB
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1220	1130	1130	1130

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	44	24	32	28
TOTAL DISSOLVED SOLIDS	MG/L	26,300	27,200	26,900	27,700
TOTAL SOLIDS	MG/L	32,000	30,600	31,000	32,000
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000	36,000	36,000	36,000
TURBIDITY	JTU	17	10	12	10
TOTAL ALKALINITY ($CaCO_3$)	MG/L	112	116	116	116
CHLORIDE (Cl)	MG/L	14,500	14,500	14,700	14,800*
TOTAL HARDNESS ($CaCO_3$)	MG/L	5,000	5,000	5,000	5,000
AMMONIA NITROGEN (N)	MG/L	<0.06	<0.06	<0.06	<0.06
NITRATE NITROGEN (N)	MG/L	0.24	0.21	0.19	0.17
TOTAL NITROGEN (N)	MG/L	0.83	0.81	0.78	1.04
B.O.D.,5-DAY,20°C	MG/L	6.9	5.6	6.0	6.1

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV.SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO.	761027	761028	761029	761030
SOURCE OF SAMPLE:	Sta Y	Sta Z	Sta AA	Sta BB
SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005				
TREATMENT:				
DATE COLLECTED:	3/16/76	3/16/76	3/16/76	3/16/76
TIME COLLECTED: Grab:	1220	1130	1130	1130

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
SALINITY	o/oo	26	26	27	28
IRON (Fe)(1)	MG/L	1.18	0.60	1.06	1.18
CADMIUM (Cd)(1)	MG/L	<0.002	<0.002	<0.002	<0.002
LEAD (Pb) (1)	MG/L	<0.01	<0.01	0.01	0.01
MERCURY (Hg) (2)	MG/L	0.0002	0.0010	<0.0002	<0.0002
ZINC (Zn) (1)	MG/L	0.019	0.014	0.041	0.016
REACTIVE PHOSPHOROUS (P)	MG/L	0.42	0.37	0.39	0.39
TOTAL PHOSPHOROUS (P)	MG/L	0.47	0.46	0.44	0.47
SILICA (SiO_2)	MG/L	2.6	3.0	3.0	3.0
SODIUM (Na) (1)	MG/L	8,600	8,600	8,300	8,100
SULFATE (SO_4)	MG/L	1,800	1,800	1,800	1,800
TOTAL COLIFORM	MPN/100 ml	7	34	13	33
FECAL COLIFORM	MPN/100 ml	5	22	2	17

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C. H. HARPER, ENV.SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO.	761031			
SOURCE OF SAMPLE:	Sta CC			
SOUTH BAY DISCHARGERS AUTHORITY BECHTEL PROJECT 10035-005				
TREATMENT:				
DATE COLLECTED:	3/16/76			
TIME COLLECTED: Grab:	1245			

Collected and Delivered by: E. Smith, D. Williams

Analysis	Units	ANALYTICAL RESULTS			
APPARENT COLOR	Color Unit	24			
TOTAL DISSOLVED SOLIDS	MG/L	26,400			
TOTAL SOLIDS	MG/L	27,300			
SPECIFIC CONDUCTANCE	Micromhos/cm	36,000			
TURBIDITY	JTU	12			
TOTAL ALKALINITY ($CaCO_3$)	MG/L	118			
CHLORIDE (Cl)	MG/L	14,700			
TOTAL HARDNESS ($CaCO_3$)	MG/L	5,000*			
AMMONIA NITROGEN (N)	MG/L	<0.06			
NITRATE NITROGEN (N)	MG/L	0.27			
TOTAL NITROGEN (N)	MG/L	1.15			
B.O.D.,5-DAY,20°C	MG/L	7.6			

COMMENTS:
*Analytical Quality Control Analysis

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,NH,CB TN Analyst

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WASTEWATER ANALYSIS REPORT

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FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CALIFORNIA 94119

LAB NO. 761031

SOURCE OF SAMPLE: Sta CC
SOUTH BAY DISCHARGERS AUTHORITY
BECHTEL PROJECT 10035-005

TREATMENT:

DATE COLLECTED: 3/16/76

TIME COLLECTED: Grab: 1245

Collected and delivered by E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS
SALINITY	o/oo	27
IRON (Fe) (1)	MG/L	0.71
CADMIUM (Cd) (1)	MG/L	<0.002
LEAD (Pb) (1)	MG/L	0.01
MERCURY (Hg) (2)	MG/L	0.0008
ZINC (Zn) (1)	MG/L	0.011
REACTIVE PHOSPHOROUS (P)	MG/L	0.44
TOTAL PHOSPHOROUS (P)	MG/L	0.49
SILICA (SiO_2)	MG/L	0.28
SODIUM (Na) (1)	MG/L	8,100
SULFATE (SO_4)	MG/L	1,800
TOTAL COLIFORM	MPN/100 ml	11*
FECAL COLIFORM	MPN/100 ml	5*

COMMENTS: *Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analytical Method:
(a) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(b) "Manual of Methods for Chemical Analysis of Water and Wastes" 1974, EPA
(c) "A Practical Handbook of Seawater Analysis" J. D. H. Strickland, T. R. Parsons

TN,SDR,NH,CB /TN Analyst

R.A. Ryder Director

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Received 3/16/76
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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO. 761003 through 761031

SOURCE OF SAMPLE:
SOUTH BAY DISCHARGERS AUTHORITY
BECHTEL PROJECT 10035-005

TREATMENT:

DATE COLLECTED: 3/16/76

TIME COLLECTED:

Collected and Delivered by: E. Smith and D. Williams

Analysis	Units	Date of Analysis*	Analytical Method
APPARENT COLOR	Color Unit	Date of Receiving	SM (1)
TOTAL DISSOLVED SOLIDS	MG/L	3/18 - 31/76	EPA (2)
TOTAL SOLIDS	MG/L	3/23 - 30/76	EPA (2)
SPECIFIC CONDUCTANCE	Micromhos cm	3/17/76	SM (1)
TURBIDITY	JTU	Date of Receiving	SM (1)
TOTAL ALKALINITY ($CaCO_3$)	MG/L	Date of Receiving	SM (1)
CHLORIDE (Cl)	MG/L	3/23 - 24/76	SM (1)
TOTAL HARDNESS ($CaCO_3$)	MG/L	3/30 - 31/76	SM (1)
AMMONIA NITROGEN (N)	MG/L	3/16 - 17/76	EPA (2)
NITRATE NITROGEN (N)	MG/L	3/16 - 17/76	SM (2)
TOTAL NITROGEN (N)	MG/L	3/16 - 17/76	SM (2)
B.O.D., 5-DAY, 20°C	MG/L	Date of Receiving	SM (2)

COMMENTS: "Date of Receiving" means that the analyses were performed on the date the samples were received or, for coliform and B.O.D., the incubation started on that date. For others, pretreatment(if required,)and analyses were completed within the designated dates.

Analytical Methods:
(1) "Standard Methods for the Examination of Water and Wastewater" 13th Edition, APHA
(2) "Manual of Methods for Chemical Analysis of Water and Wastes," 1974, EPA
(3) "A Practical Handbook of Seawater Analysis" J.D.H. Strickland, T. R. Parsons

TN /TN Analyst

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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 3/16/76
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WASTEWATER ANALYSIS REPORT

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV. SERVICES DEPT

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

LAB NO. 761003 through 761031

SOURCE OF SAMPLE:
SOUTH BAY DISCHARGERS AUTHORITY
BECHTEL PROJECT 10035-005

TREATMENT:

DATE COLLECTED: 3/16/76

TIME COLLECTED:
Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	Date of Analysis	Analytical Method
SALINITY	o/oo	-	Strickland (3)
IRON (Fe)	MG/L	3/26 - 5/1/76	EPA (2)
CADMIUM (Cd)	MG/L	3/26 - 5/1/76	EPA (2)
LEAD (Pb)	MG/L	3/26 - 5/1/76	EPA (2)
MERCURY (Hg)	MG/L	3/26 - 5/1/76	EPA (2)
ZINC (Zn)	MG/L	3/26 - 5/1/76	EPA (2)
REACTIVE PHOSPHOROUS (P)	MG/L	Date of Receiving	EPA (2)
TOTAL PHOSPHOROUS (P)	MG/L	3/17 - 18/76	EPA (2)
SILICA (SiO_2)	MG/L	3/25 - 29/76	SM (1)
SODIUM (Na)	MG/L	3/25 - 5/ /76	EPA (2)
SULFATE (SO_4)	MG/L	3/22 - 24/76	SM (1)
TOTAL COLIFORM	MPN/100 ml	Date of Receiving	SM (1)
FECAL COLIFORM	MPN/100 ml	Date of Receiving	SM (1)

COMMENTS: "Date of Receiving" means that the analyses were performed on the date the samples were received or, for coliform and B.O.D., the incubation started on that date. For others, pretreatment(if required,)and analyses were completed within the designated dates.

Analytical Methods:
(1) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(2) "Manual of Methods for Chemical Analysis of Water and Wastes," 1974, EPA
(3) "A Practical Handbook of Seawater Analysis", J.D.H. Strickland, T. R. Parsons

TN MTN Analyst
R.A.Ryder Director

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Reported 5/16/76

WASTEWATER ANALYSIS REPORT

Page 1 of 1

FOR BECHTEL CORPORATION REPORT TO DR. C.M. HARPER, ENV.SERV. DEPT.

ADDRESS P.O. BOX 3965, SAN FRANCISCO, CA. 94119

Analytical Quality Assurance Data

To assure reliability and accuracy of the analytical methods used, an Analytical Quality Control Program is routinely practiced in this laboratory. The analytical quality control data developed pertinent to analysis of South Bay water samples collected on 3/16/76 for the South Bay Dischargers Authority, Bechtel Project 10035-005.

SUMMARY OF ANALYTICAL QUALITY CONTROL ANALYSIS DATA

Parameter	No. Samples Analyzed	Range Conc. Analyzed	Range Std.Dev.S	Range, Spike Recovery,%
Apparent Color	2	1.0 - 2.4 Color Unit	1.0 - 2.4	-
T. Diss. Solids	3	22,900 - 27,100 Mg/L	150 - 940	-
Total Solids	3	25,500 - 30,800 Mg/L	370 - 660	-
Turbidity	2	14 - 19 JTU	1.0	-
T. Alkalinity	3	117 - 127 Mg/L	2.0	-
Chloride	3	12,900 - 14,800 Mg/L	100 - 120	100 - 117
T. Hardness	3	4,500 - 5,000 Mg/L	40 - 50	98 - 102
T. Kjeld. Nitrogen	3	1.12 - 1.96 Mg/L	0.01 - 0.18	98 - 103
Ammonia Nitrogen	3	<0.01 - 0.01	-	91 - 100
Nitrate Nitrogen	3	0.34 - 0.68 Mg/L	0.02 - 0.06	80 - 95
Iron	3	0.48 - 1.75 Mg/L	0.07 - 0.08	83 - 99
Cadmium	3	<0.02	-	106 - 107
Lead	3	<0.01 - 0.01	-	91 - 100
Mercury	3	<0.0002	-	80 - 90
Zinc	3	0.012 - 0.016	0.001 - 011	91 - 93
React.Phosphorous	3	0.49 - 0.81	0.02 - 0.04	93
T. Phosphorous	3	1.06 - 0.55	0.02 - 0.03	96 - 103
Silica	3	1.9 - 6.2	0.1 - 0.2	91 - 99
Sulfate	3	1,650 - 1,800	15 - 35	94 - 103

COMMENTS:

TN /TN Analyst
R.A.Ryder Director
R. A. Ryder

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PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
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Received 11/12/76
Reported 1/21/77

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation **REPORT TO** Dr. C. M. Harper, Env. Services Dep

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765400	765401	765402	765403
SOURCE OF SAMPLE:	A	B	C	D
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1400	1405	1405	1410

Collected and Delivered by: E. Smith & D. Williams

Analysis	**Units**	**ANALYTICAL RESULTS**			
Apparent Color	Color Unit	52*	33	63	19
Total Dissolved Solids	Mg/1	14,000	24,100	26,100*	30,400
Total Solids	Mg/1	14,900	25,700	27,200	31,100
Specific Conductance	Micromhos/cm	23,200*	37,200	40,200	43,900
Turbidity	JTU	13	8.6	8.1	6.3
Total Alkalinity ($CaCO_3$)	Mg/1	258	188	178	162
Chloride (Cl)	Mg/1	7,000*	13,000	13,000	15,000
Total Hardness ($CaCO_3$)	Mg/1	2,700*	4,300	4,900	5,300
Ammonia Nitrogen (N)	Mg/1	2.78	0.11	1.30*	0.17
Nitrate Nitrogen (N)	Mg/1	1.30	1.06	1.45*	0.81
Total Nitrogen (N)	Mg/1	11.07	5.30	4.48	2.73
B.O.D., 5-Day, 20°C	Mg/1	3.4	2.2	2.4	1.5

COMMENTS:

* Analytical Quality Control Analysis

TN, SDR, NH, CB/TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40,

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657 Howard Street, San Francisco 94105
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Received 11/12/76
Reported 1/21/77

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation **REPORT TO** Dr. C. M. Harper, Env. Services Dept.

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765400	765401	765402	765403
SOURCE OF SAMPLE:	A	B	C	D
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED:	1400	1405	1405	1410

Collected and delivered by: E. Smith & D. Williams

Analysis	**Units**	**ANALYTICAL RESULTS**			
Salinity	0/00	12.6	23.1	23.1	26.6
Iron (Fe) (1)	Mg/1	0.68	0.52	0.43	0.30
Cadmium (Cd) (1)	Mg/1	<0.002	<0.002	<0.002	< 0.002
Lead (Pb) (1)	Mg/1	0.01	0.01	<0.01	<0.01
Mercury (Hg) (2)	Mg/1	0.0002	0.0005	0.0005*	0.0005
Zinc (Zn) (1)	Mg/1	0.033	0.022	0.017	0.013
Reactive Phosphorous (P)	Mg/1	2.9	1.9	1.6	1.1
Total Phosphorous (P)	Mg/1	2.9	2.3	1.6	1.3
Silica (SiO_2)	Mg/1	23*	22	7.5	8.0
Sodium (Na) (1)	Mg/1	4,200	8,100	7,900	8,700
Sulfate (SO_4)	Mg/1	840*	1,600	1,700	2,100
Total Colifroms	MPN/100ml	≥24,000	2,300	3,300	330
Fecal Coliform	MPN/100ml	≥24,000	1,300	3,300	130

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SDR, NH, CB TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

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Reported 1/21/[illegible]

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	785404	765405	765406	765407
SOURCE OF SAMPLE:	E	F	G	H
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1420	1425	1435	1450

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	31	14	12	15
Total Dissolved Solids	Mg/1	25,300	29,400	31,900	32,900
Total Solids	Mg/1	27,000	31,400*	32,900	34,600
Specific Conductance	Micromhos cm	39,000	44,500	44,500	45,100
Turbidity	JTU	8.8	4.8	4.8	4.5
Total Alkalinity($CaCO_3$)	Mg/1	178	158	152	155
Chloride(Cl)	Mg/1	13,000	15,500	15,500	15,500
Total Hardness($CaCO_3$)	Mg/1	4,500	5,400	5,500	5,400
Ammonia Nitrogen(N)	Mg/1	0.11	< 0.05*	0.06	0.90
Nitrate Nitrogen (N)	Mg/1	1.00	1.07*	0.83	0.76
Total Nitrogen(N)	Mg/1	9.33	2.81	2.24	1.76
B.O.D., 5-Day, 20°C	Mg/1	1.7	< 1.0	< 1.0	< 1.0

COMMENTS: * Analytical Quality Control Analysis

TN, SDR, NH, CB (TN) Analyst

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 6 June 1975

R.A. Ryder
R. A. Ryder Director

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services D

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765404	765405	765406	765407
SOURCE OF SAMPLE:	E	F	G	H
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1420	1425	1435	1450

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
~~Salinity~~	0/100	23.1	27.5	27.5	27.5
Iron(Fe) (1)	Mg/1	0.52*	0.26	0.30	0.30
Cadmium (Cd) (1)	Mg/1	< 0.002*	< 0.002	< 0.002	< 0.002
Lead(Pb) (1)	Mg/1	< 0.01	< 0.01	< 0.01	< 0.01
Mercury (Hg) (2)	Mg/1	0.0010*	0.0012	0.0006	0.0010
Zinc (Zn) (1)	Mg/1	0.017*	0.014	0.012	0.009
Reactive Phosphorous (P)	Mg/1	1.6	1.2	1.2	1.2
Total Phosphorous (P)	Mg/1	1.7	1.2	1.2	1.2
Silica (SiO_2)	Mg/1	8.8	1.9	6.0	2.3
Sodium (Na) (1)	Mg/1	8,200	9,600	9,800	9,000
Sulfate (SO_4)	Mg/1	1,700	2,100	2,200	2,200
Total Coliform	MPN/100ml	7,900	64*	33	1,300
Fecal Coliform	MPN/100ml	7,900	41*	33	46

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SDR, NH, CB (TN) Analyst

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 6 June 1975

R.A. Ryder
R. A. Ryder Director

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dep

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.		765408	765409	765410	765411
SOURCE OF SAMPLE:		I	J	K	L
South Bay Dischargers Authority Bechtel Project 10035-005					
TREATMENT:					
DATE COLLECTED:		11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:		1445	1240	1240	1240

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	14	14	15	13
Total Dissolved Solids	Mg/1	32,100	34,400	32,000	31,900
Total Solids	Mg/1	36,800	35,100	35,400	34,000
Specific Conductance	Micromhos/cm	46,300	46,300	46,300	46,300
Turbidity	JTU	4.5	5.0	5.5	4.1
Total Alkalinity($CaCO_3$)	Mg/1	165	142	144	149
Chloride (Cl)	Mg/1	16,500	16,500	16,500	16,500
Total Hardness ($CaCO_3$)	Mg/1	5,500	5,900	5,600	5,500
Ammonia Nitrogen (N)	Mg/1	0.09*	0.18	0.01	< 0.05
Nitrate Nitrogen (N)	Mg/1	0.90*	0.61	0.61	0.66
Total Nitrogen (N)	Mg/1	1.84	1.10	1.10	0.72
B.O.D., 5-Day, 20°C	Mg/1	1.3	1.0	< 1.0	< 1.0

COMMENTS: * Analytical Quality Control Analysis

TN, SDR, HH, CB / TN Analyst

R. A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De,

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.		765408	765409	765410	765411
SOURCE OF SAMPLE:		I	J	K	L
South Bay Dischargers Authority Bechtel Project 10035-005					
TREATMENT:					
DATE COLLECTED:		11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab		1445	1240	1240	1240

Collected and delivered by: E. Smith & D.Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	29.2	29.2	29.2	29.2
Iron (Fe) (1)	Mg/1	0.31	0.37	0.37	0.27
Cadmium (Cd) (1)	Mg/1	<0.002	<0.002	<0.002	<0.002
Lead (Pb) (1)	Mg/1	< 0.01	<0.01	0.01	0.05
Mercury (Hg) (2)	Mg/1	0.0012	0.0004	0.0002	0.0003
Zinc (Zn) (1)	Mg/1	0.009	0.013	< 0.005	0.014
Reactive Phosphorous(P)	Mg/1	0.79	0.90	0.82	0.82
Total Phosphorous (P)	Mg/1	0.82	0.85	0.85	0.87
Silica (SiO_2)	Mg/1	3.3	1.9	1.4	1.8
Sodium (Na) (1)	Mg/1	10,500	9,900	9,600	9,800
Sulfate (SO_4)	Mg/1	2,200	2,200	2,300*	2,300
Total Coliform	MPN/100ml	23	13	70	33
Fecal Coliform	MPN/100ml	23	5	23	17

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer
(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SDR, HH, CB / TN Analyst

R. A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services D.
ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765412	765413	765414	765415
SOURCE OF SAMPLE:	M	N	O	P
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED:	1030	1030	1030	1115

Collected and Delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	15	12	17	13
Total Dissolved Solids	Mg/1	31,800	33,000	33,800*	30,300
Total Solids	Mg/1	36,100	36,800	35,200	35,500
Specific Conductance	Micromhos / cm	46,300	47,500	46,600	46,300
Turbidity	JTU	4.7	5.6*	5.7	4.3
Total Alkalinity($CaCO_3$)	Mg/1	142	140	145	144
Chloride(Cl)	Mg/1	17,000	17,000	17,000	17,000
Total Hardness($CaCO_3$)	Mg/1	5,400	5,800*	5,600	5,600
Ammonia Nitrogen(N)	Mg/1	0.27	0.09*	0.09	0.27
Nitrate Nitrogen(N)	Mg/1	0.70	0.63	0.63	0.66
Total Nitrogen (N)	Mg/1	1.19	1.12	0.76	1.61
B.O.D.,5-Day, 20°C	Mg/1	<1.0	<1.0	<1.0	<1.0

COMMENTS: * Analytical Quality Control Analysis

TN, SDR, NH, CB TN Analyst

R. A. Ryder Director
R. A. Ryder

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services D
ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765412	765413	765414	765415
SOURCE OF SAMPLE:	M	N	O	P
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1030	1030	1030	1115

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	30.1	30.1	30.1	30.1
Iron(Fe) (1)	Mg/1	0.92	1.11	1.02	0.32
Cadmium(Cd) (1)	Mg/1	<0.002	<0.002	<0.002	<0.002
Lead (Pb) (1)	Mg/1	<0.01	<0.01	0.01	<0.01
Mercury (Hg) (2)	Mg/1	0.0027	0.0022	0.0030*	0.0006
Zinc (Zn) (1)	Mg/1	0.040	0.040	0.045	0.019
Reactive Phosphorous(P)	Mg/1	0.76	0.78	0.82	0.78
Total Phosphorous(P)	Mg/1	0.78	0.78	0.82	0.85
Silica (SiO_2)	Mg/1	0.7	8.5	3.8	4.0
Sodium (Na) (1)	Mg/1	9,800	7,900	10,400	9,500
Sulfate (SO_4)	Mg/1	2,200	2,200	2,300	2,100
Total Coliform	MPN/100ml	13	23	79	70
Fecal Coliform	MPN/100ml	13	23	33	23

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SDR, NH, CB TN Analyst

R. A. Ryder Director
R. A. Ryder

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services D

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765416	765417	765418	765419
SOURCE OF SAMPLE:		R	S	T
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1115	1115	1105	1140

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	15*	13	11	19
Total Dissolved Solids	Mg/1	30,200	30,400	30,700	31,800
Total Solids	Mg/1	36,000*	35,100	36,100	34,400
Specific Conductance	Micromhos/cm	46,900	46,900	47,500	46,900
Turbidity	JTU	5.0	5.0	4.2	6.1
Total Alkalinity($CaCO_3$)	Mg/1	145	145	145	144
Chloride(Cl)	Mg/1	16,500	16,800*	17,000	16,500
Total Hardness($CaCO_3$)	Mg/1	5,800	5,800	5,900	5,700
Ammonia Nitrogen(N)	Mg/1	0.09	0.18	< 0.05	0.09
Nitrate Nitrogen(N)	Mg/1	0.74	0.66	0.59	0.68
Total Nitrogen(N)	Mg/1	1.24	1.16	1.08	1.18
B.O.D.,5-Day,20°C	Mg/1	1.0	1.0	< 1.0	< 1.0

COMMENTS: * Analytical Quality Control Analysis

TH, SDR, NH, CB/TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June 1975

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765416	765417	765418	765419
SOURCE OF SAMPLE:	Q	R	S	T
South Bay Dischargers Authority Bechtel Project 10035-0005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1115	1115	1105	1140

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	29.2	29.7	30.1	29.2
Iron(Fe)(1)	Mg/1	1.18*	1.15	0.28	1.14
Cadmium(Cd)(1)	Mg/1	< 0.002*	< 0.002	< 0.002	< 0.002
Lead (Pb)(1)	Mg/1	< 0.01*	< 0.01	0.02	< 0.01
Mercury (Hg)(2)	Mg/1	0.0027*	0.0028	0.0002	0.0026
Zinc (Zn)(1)	Mg/1	0.063*	0.042	0.066	0.066
Reactive Phosphorous(P)	Mg/1	0.90	0.38	0.76	0.85
Total Phosphorous(P)	Mg/1	0.88	0.88	0.82	0.85
Silica (SiO_2)	Mg/1	1.0	0.9	1.9	7.2
Sodium (Na)(1)	Mg/1	9,800	9,400	9,100	10,200
Sulfate (SO_4)	Mg/1	2,200	2,200	2,200	2,300
Total Coliform	MPN/100ml	79	49	5	17
Fecal Coliform	MPN/100ml	27	13	2	17

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TH, SDR, NH, CB/TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analys[illegible] f Pollutants - Proposed Guidelines for Establishing Te[illegible] Procedures," Federal Register, Vol 40, No. 111, 9 Je[illegible] 1975

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.		765420	765421	765422	765423
SOURCE OF SAMPLE:		U	V	W	X
South Bay Dischargers Authority Bechtel Project 10035-005					
TREATMENT:					
DATE COLLECTED:		11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED:		1140	1140	1305	1305

Collected by and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	13	14	18	12
Total Dissolved Solids	Mg/1	30,400	31,400	32,900*	32,200
Total Solids	Mg/1	36,100	36,300	36,400	35,000
Specific Conductance	Micromhos/cm	46,900	46,900	46,900	46,900
Turbidity	JTU	5.7	5.1	7.0	7.0
Total Alkalinity($CaCO_3$)	Mg/1	145	145	149	145
Chloride (Cl)	Mg/1	17,000	17,000	17,000	16,500
Total Hardness($CaCO_3$)	Mg/1	5,700	5,800	5,500	5,800
Ammonia Nitrogen(N)	Mg/1	< 0.05	0.09	0.09	0.45
Nitrate Nitrogen(N)	Mg/1	0.58	0.68	0.72	0.76
Total Nitrogen(N)	Mg/1	1.07	1.18	1.22	1.26
B.O.D., 5-Day,20°C	Mg/1	1.4	<1.0	< 1.0	<1.0

COMMENTS: * Analytical Quality Control Analysis

TN, SDR, NH, CB TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.		765420	765421	765422	765423
SOURCE OF SAMPLE:		U	V	W	X
South Bay Dischargers Authority Bechtel Project 10035-005					
TREATMENT:					
DATE COLLECTED:		11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:		1140	1140	1305	1305

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	30.1	30.1	30.1	29.2
Iron (Fe) (1)	Mg/1	0.43	1.17	0.56	0.52
Cadmium(Cd) (1)	Mg/1	< 0.002	< 0.002	< 0.002	< 0.002
Lead(Pb) (1)	Mg/1	<0.01	< 0.01	< 0.01	< 0.01
Mercury (Hg) (2)	Mg/1	0.0009	0.0026	0.0007	0.0002
Zinc (Zn) (1)	Mg/1	0.026	0.028	0.016	0.008
Reactive Phosphorous(P)	Mg/1	0.82	0.85	0.85	0.85
Total Phosphorous(P)	Mg/1	0.82	0.88	0.85	0.88
Silica (SiO_2)	Mg/1	3.5	3.3	1.7	9.7
Sodium (Na) (1)	Mg/1	9,900	10,500	10,100	9,800
Sulfate (SO_4)	Mg/1	2,200	2,300	2,200	2,200
Total Coliform	MPN/100ml	56*	23	33	33
Fecal Coliform	MPN/100ml	11*	23	17	1

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SDR, NH, CB TN Analyst

R.A. Ryder
R. A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, Page 13 of 19 PEL 5048-5

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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services D.

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765424	765425	765426	765427
SOURCE OF SAMPLE:	Y	Z	AA	BB
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1305	1220	1220	1220

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	16	12	18	13
Total Dissolved Solids	Mg/1	31,800	31,800	31,600	31,200
Total Solids	Mg/1	35,400	38,400	35,600	35,700
Specific Conductance	Micromhos/cm	46,900	46,900	46,900	46,900
Turbidity	JTU	16	12	18	13
Total Alkalinity($CaCO_3$)	Mg/1	144	147	144	142
Chloride (Cl)	Mg/1	16,500	16,500	16,500	17,000
Total Hardness($CaCO_3$)	Mg/1	5,700	5,900	5,800	5,600
Ammonia Nitrogen(N)	Mg/1	< 0.05	0.18	< 0.05	< 0.05
Nitrate Nitrogen(N)	Mg/1	0.70	0.61	0.58	0.70
Total Nitrogen(N)	Mg/1	1.20	1.55	1.08	0.75
B.O.D., 5-Day, 20°C	Mg/1	< 1.0	< 1.0	< 1.0	< 1.0

COMMENTS:

TN, SDR, NH, CB (TN) Analyst

R.A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40.

Page 14 of 19 PEL 5048

PACIFIC ENVIRONMENTAL LABORATORY
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WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765424	765425	765426	765427
SOURCE OF SAMPLE:	Y	Z	AA	BB
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76	11/12/76	11/12/76	11/12/76
TIME COLLECTED: Grab:	1305	1220	1220	1220

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	29.2	29.2	29.2	30.1
Iron (Fe) (1)	Mg/1	0.40	1.11*	1.36	0.33
Cadmium(Cd) (1)	Mg/1	< 0.002	< 0.002	< 0.002	< 0.002
Lead (Pb) (1)	Mg/1	< 0.01	< 0.01	0.01	< 0.01
Mercury(Hg) (2)	Mg/1	0.0013	0.0042*	0.0047	0.0003
Zinc (Zn) (1)	Mg/1	0.007	0.042*	0.070	0.047
Reactive Phosphorous(P)	Mg/1	0.85	0.78	0.78	0.78
Total Phosphorous(P)	Mg/1	0.90	0.85	0.85	0.88
Silica (SiO_2)	Mg/1	9.8	9.5	9.3	9.4
Sodium (Na) (1)	Mg/1	9,600	9,700	9,300	9,300
Sulfate (SO_4)	Mg/1	2,300	2,200	2,200	2,200
Total Coliform	MPN/100ml	23	33	51	23
Fecal Coliform	MPN/100ml	5	33	20	8

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

TN, SCR, NH, CB (TN) Analyst

R.A. Ryder Director

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40.

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 11/12/76
Reported 1/21/77

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services De

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765428			
SOURCE OF SAMPLE:	CC			
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76			
TIME COLLECTED: Grab:	1340			

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Apparent Color	Color Unit	15*			
Total Dissolved Solids	Mg/l	31,000			
Total Solids	Mg/l	33,500*			
Specific Conductance	Micromhos/cm	46,500*			
Turbidity	JTU	5.2*			
Total Alkalinity ($CaCO_3$)	Mg/l	145*			
Chloride (Cl)	Mg/l	16,900*			
Total Hardness ($CaCO)_3$	Mg/l	5,630*			
Ammonia Nitrogen (N)	Mg/l	$<$ 0.06			
Nitrate Nitrogen (N)	Mg/l	0.76			
Total Nitrogen (N)	Mg/l	1.27			
B.O.D., 5-Day, 20°C	Mg/l	$<$ 1.0			

COMMENTS: * Analytical Quality Control Analysis

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June 1975

TN, SDR, NH, CB TN Analyst

R.A. Ryder Director
R. A. Ryder

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 11/12/76
Reported 1/21/77

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services Dept

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO.	765428			
SOURCE OF SAMPLE:	CC			
South Bay Dischargers Authority Bechtel Project 10035-005				
TREATMENT:				
DATE COLLECTED:	11/12/76			
TIME COLLECTED: Grab:	1340			

Collected and delivered by: E. Smith & D. Williams

Analysis	Units	ANALYTICAL RESULTS			
Salinity	0/00	29.9			
Iron (Fe) (1)	Mg/l	0.35			
Cadmium (Cd) (1)	Mg/l	$<$ 0.002			
Lead (Pb) (1)	Mg/l	$<$ 0.01			
Mercury (Hg) (2)	Mg/l	0.014			
Zinc (Zn) (1)	Mg/l	0.010			
Reactive Phophorous (P)	Mg/l	0.95			
Total Phosphorous (P)	Mg/l	0.95			
Silica (SiO_2)	Mg/l	7.5			
Sodium (Na) (1)	Mg/l	9,100			
Sulfate (SO_4)	Mg/l	2,100*			
Total Coliform	MPN/100ml	17			
Fecal Coliform	MPN/100ml	13			

COMMENTS: * Analytical Quality Control Analysis

(1) Analysis by Atomic Absorption Spectrophotometer

(2) Analysis by Cold Vapor Atomic Absorption Spectrophotometer

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, [illegible]

TN, SDR, NH, CB TN Analyst

R.A. Ryder Director
R. A. Ryder

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 11/12/
Reported 1/21/

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO. 765400 through 765428

SOURCE OF SAMPLE: South Bay Water Samples
South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 11/12/76

TIME COLLECTED:
Collected and delivered by: E. Smith & D. Willaim

Analysis	Units	Date of Analysis			Analytical Method
Apparent Color	Color Unit	11/13/76			SM (1)
Total Dissolved Solids	Mg/1	11/17-18/76			EPA (2)
Total Solids	Mg/1	11/17/76-1/11/77			EPA (2)
Specific Conductance	Micromhos mc	11/13/76			SM (1)
Turbidity	JTU	11/13/76			SM (1)
Total Alkalinity($CaCO_3$)	Mg/1	11/13/76			SM (1)
Chloride (Cl)	Mg/1	1/11/77			SM (1)
Total Hardness ($CaCO_3$)	Mg/1	1/6/77			SM (1)
Ammonia Nitrogen (N)	Mg/1	11/13-16/76			EPA (2)
Nitrate Nitrogen (N)	Mg/1	11/13/76			SM (1)
Total Nitrogen (N)	Mg/1	11/13-16/76			SM (1)
B.O.D., 5-Day, 20°C	Mg/1	Date of Receiving*			SM (1)

COMMENTS: * The samples were received at 4:35PM on 11/12/76 and the incubation of B.O.D.s were started between 5:30 PM and 7:30 PM.

ANALYTICAL METHODS
(1) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(2) "Manual for Chemical Analysis of Water and Wastes," 1974, EPA
(3) "Practical Handbook of Seawater Analysis," J.D.H. Strickland, T.R. Parsons.

TN, SDR, NH, CB (TN Analyst

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

R.A. Ryder Director
R. A. Ryder

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 11/12/76
Reported 1/21/77

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C.M. Harper, Env. Services

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO. 765400 through 765428

SOURCE OF SAMPLE: South Bay Water Samples
South Bay Discharge Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 11/12/76

TIME COLLECTED:
Collected & delivered by: E. Smith & D. Williams

Analysis	Units	Date of Analysis			
Salinity	0/00	1/7-8/77			
Iron (Fe)	Mg/1	11/24/76-1/10/77			
Cadmium (Cd)	Mg/1	11/24/76-1/10/77			
Lead (Pb)	Mg/1	11/24/76-1/10/77			
Mercury (Hg)	Mg/1	11/24/76-1/10/77			
Zinc (Zn)	Mg/1	11/24/76-1/10/77			
Reactive Phosphorous (P)	Mg/1	11/13-15/77			
Total Phosphorous (P)	Mg/1	11/13-15/77			
Silica (SiO_2)	Mg/1	1/4-5/77			
Sodium (Na)	Mg/1	11/24/76-1/10/77			
Sulfate (SO_4)	Mg/1	11/13-12/1/76			
Total & Fecal Coliform	MPN/100ml	Date of Receiving*			

COMMENTS: * The samples were received at PM on 11/12/76 and incubation for coliforms were started between 5:30 PM and 7:30 PM.

ANALYTICAL METHODS
(1) "Standard Methods for the Examination of Water and Wastewater," 13th Edition, APHA
(2) "Manual for Chemical Analysis of Water and Wastes," 1974, EPA
(3) "Practical Handbook of Sewater Analysis," J.D.H. Strickland, T. R. Parsons.

TN, SDR, NH, CB (TL Analyst

Analysis: "Analysis of Pollutants - Proposed Guidelines for Establishing Test Procedures," Federal Register, Vol 40, No. 111, 9 June, 1975

R.A. Ryder Director
R. A. Ryder

PACIFIC ENVIRONMENTAL LABORATORY
657 Howard Street, San Francisco 94105
PHONE - (415) 495 - 6627

Received 11/12/76
Reported 1/21/7?

WASTEWATER ANALYSIS REPORT

FOR Bechtel Corporation REPORT TO Dr. C. H. Harper, Env. Services Dep

ADDRESS P.O. Box 3965, San Francisco, CA

LAB NO. 765400 through 765428

SOURCE OF SAMPLE: South Bay Water Samples

South Bay Dischargers Authority
Bechtel Project 10035-005

TREATMENT:

DATE COLLECTED: 11/12/76

TIME COLLECTED:

Collected & delivered by: E. Smith & D. Williams

ANALYTICAL QUALITY ASSURANCE DATA

To assure reliability and accuracy of the Analytical methods used, an Analytical Quality Control Program is routinely practiced in this laboratory. The Analytical Quality Control data developed pertinent to analysis of South Bay water samples collected on 11/12/76 for the South Bay Dischargers Authority, Bechtel Project 10035-005 are summarized herein.

SUMMARY OF ANALYTICAL QUALITY CONTROL ANALYSIS DATA

Parameter	No. of Samples Analyzed	Range, Conc.	Range Std. Dev. S	Range, Spike Recovery,%
Apparent Color	3	15-52 Color Unit	1.0-1.2	-
T. Dissolved	3	26,100-33,800 Mg/1	290-1,400	-
Total Solids	3	31,400-36,000 Mg/1	620-1,200	-
Spec. Conductance	3	23,200-46,900µ mhos/cm	100-250	-
Turbidity	3	5.6-13 JTU	0.0-0.1	-
T. Alkalinity		140-258 Mg/1	1.0-2.3	-
Chloride	3	7,000-16,900 Mg/1	200-250	98-100
T. Hardness	3	2,600-5,800 Mg/1	45-50	101 (1)
Ammonia Nitrogen	3	<0.05-1.3 Mg/1	0.0-0.1	96-134
T. Kjeld. Nitrogen	3	0.90-2.80 Mg/1	0.19-0.42	103-106
Nitrate Nitrogen	3	0.90-1.45 Mg/1	0.09-0.13	94-105
Iron	3	0.52-1.18 Mg/1	0.03-0.05	94-105
Cadmium	3	<0.002 Mg/1	-	106-110
Lead	3	<0.01 Mg/1	-	100-101
Mercury	3	0.003-0.0047 Mg/1	0.00001-0.00020	88-99
Zinc	3	0.017-0.063 Mg/1	0.017-0.063	92-104
React. Phosphorous	3	0.90-2.9 Mg/1	0.0-0.10	99 (1)
T. Phosphorous	3	0.87-2.9 Mg/1	0.01-0.10	100 (1)
Silica	3	3.3-22 Mg/1	0.1-0.5	91-102
Sodium	3	8,200-9,800 Mg/1	200-330	100-103
Sulfate	3	840-2,300 Mg/1	20-50	101 (1)

COMMENTS: (1) Based on a single sample

TN (TN) Analyst

R.A.Ryder Director

alysis: "Analysis of Pollutants - Proposed Guidelines for
[illegible] Test Procedures" Federal Register, Vol 40,

H.3 BAY STUDY PROGRAM

E.H. SMITH and ASSOCIATES
September 1977 - November 1977

E. H. Smith & Associates
Biological Consultants

4090 Harrison Grade Rd
Sebastopol, Ca. 95472
(707) 874-3108

October 20, 1977

Dr. C. M. Harper
Environmental Services Dept.
Betchel Incorporated
P.O. Box 3965
San Francisco, Ca. 94119

Dear Carol:

Enclosed is the data for the first sampling effort for the South Bay project. The chemical assays have been completed for the second effort and the data will be forewarded to you within 1 week to 10 days.

Any questions concerning the data should be accompanied by both the sampling number and laboratory descriptor.

Sincerely,

William G. Rotz

William G. Rotz

INTRODUCTION

The field work for the data presented here was performed during the period of August 23 -25, 1977. Methods and frequency of sample collection were as those designated in the Bay Study Specifications dated December 5, 1977. Concerning assay of the samples, dissolved oxygen, p.h., temperature and salinity were determined in the field by E.H. Smith & Associates. Prior to the sampling effort, the D.O. meters and salinometer used for these determinations were calibrated against the Winkler and silver nitrate titrations, respectively. Unusual salinity values were verified by titration from collected samples shortly after return from the field. The remaining parameters specified for assay were processed by the Pacific Marine Station Water Quality Laboratory, Dillon Beach, Ca. These parameters are marked by an asterisk (*) and the samples assayed are accompanied by a laboratory descriptor number. Field samples were preserved according to the methods recommended by the water quality laboratory, and were returned for assay within a few hours after collection.

The data are arranged by parameter and are grouped according to source evaluation. Explanation of the labeling systems and additional information pertinent to sampling for each source evaluation is presented in sections I, II and III.

Concerning D.O. measurements taken in the sloughs, it was observed that the concentration of oxygen in Newark Slough was not uniformly distributed throughout the water column. For example, at 1500 hours, the oxygen measurement taken at the surface was 10.4 mg/l, whereas 7.3 mg/l was observed near the slough bottom.

Similarly at 17oo hours, the surface oxygen value was 11.9 mg/l and decreased with depth to 5.5 mg/l near the bottom. This trend has been investigated further in subsequent studies for all three sloughs. The results of the stratified measurements will be given in a future report.

Labeling Systems

I Diffuse Source Load Evaluation

Samples for the above evaluation were collected on August 24, 1977. The labeling system is as follows:

824 Mo - 1-6
824 Ne - 1-6
824 FT - 1-12

The first three digits indicate date of sampling. The letter code for the sampling sites are: Mowry Slough (Mo), Newark Slough (Ne), and Faber Tract Marsh (FT). The last number indicates the sequence of sample collection, e.g. samples 1 through 6 or 1 through 12.

Slough Hydrology

Neutrally buoyant driffter bottles were used for the determinations of water velocity at the time of sample collection. The reliability of the drifters as velocity indicators was tested prior to sampling using fluorometric techniques. Depths of the sloughs at a given time were read directly from a stage rod installed in the deepest part of each slough. Cross sectional area was derived from measured width of each slough and from bottom profiles determined with a recording fathometer. Flow rates of each slough are presented as ft^3/sec (cfs).

II Receiving Water

The labeling scheme for the receiving water sampling is as follows:

825 RW - 31 - I

Again the first three digits refer to the date of collection. RW - 31 indicates the grid number representing the location of the receiving water station. The Roman numeral denotes the number of times the grid location was sampled. As indicated on page II-2, five stations were not sampled because of poor weather conditions. Two other stations were found to be inaccesible by boat and land. Adjustments have since been made at these locations and samples have been collected for these grids during the second phase of the project.

III Point Source Loading Evaluation

Samples from four point source locations were collected over a 24 hour period on August 23-24, 1977. At Palo Alto, Union-Newark, Union-Irvington, and San Jose, samples were collected every 4 hours. Because of technical problems, the Sunnyvale plant did not participate. Samples were returned to the Water Quality Laboratory and a representative sample was composited prior to assay using the flow data submitted for each time of collection. Three os the six samples submitted by Union-Irvington had no flow data. It was necessary to assay each of the three samples individually. These samples are accompanied by laboratory descriptor numbers. The Irvington composite was proportioned from three samples.

The labeling scheme for the point source samples is as follows:

82324 U-N
82324 U-Ir
82324 SJ
82324 PA

The first five digits indicates that the sample represents a composite taken over the 23-24 of August. The letters code for the treatment plant: Union-Irvington (U-Ir), Union-Newark (U-N), San Jose (SJ), and Palo Alto (PA).

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Time of Collection	Sample #	D.O. mg/1	Temp. C°	Salinity ppt	p.H.
0900	824Mo1	3.4	23.0	27.0	7.0
1100	824Mo2	3.6	24.0	27.0	7.0
1300	824Mo3	3.6	26.0	27.0	7.5
1500	824Mo4	N.T.	26.0	22.0	7.4
1700	824Mo5	6.2	25.0	25.0	7.6
1900	824Mo6	6.5	24.0	27.5	7.2

Newark Slough

Date of Collection 8/24/77

Time of Collection	Sample #	D.O. mg/1	Temp. C°	Salinity ppt	p.H.
0900	824Ne1	1.6	21.5	32.0	7.6
1100	824Ne2	3.1	21.5	32.0	7.6
1300	824Ne3	4.2	21.5	31.0	7.0
1500	824Ne4	10.4	24.8	32.0	7.2
1700	824Ne5	11.9	25.0	32.0	7.4
1900	824Ne6	8.6	24.0	33.0	7.5

N.T. = Not Taken

E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Non* Filtrable Residue mg/l	Filtrable* Residue mg/l	Total* Ortho-PO$_4$ mg/l
824Mo1	0900	3431	60	37,100	1.1
824Mo2	1100	3429	93	35,300	1.1
824Mo3	1300	3432	96	34,700	1.0
824Mo4	1500	3453	121	30,200	0.77
824Mo5	1700	3427	62	24,300	0.70
824Mo6	1900	3430	57	33,900	0.93

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non* Filtrable Residue mg/l	Filtrable* Residue mg/l	Total* Ortho-PO$_4$ mg/l
824Ne1	0900	3416	73	41,700	2.2
824Ne2	1100	3426	110	40,000	2.1
824Ne3	1300	3428	130	43,000	2.1
824Ne4	1500	3425	270	40,700	2.5
824Ne5	1700	3424	130	40,500	2.4
824Ne6	1900	3415	100	28,000	2.2

E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Nitrite* mg/l	Chlorophyll a* mg/m^3
824Mo1	0900	3431	0.049	8.6
824Mo2	1100	3429	0.053	22
824Mo3	1300	3432	0.045	12
824Mo4	1500	3453	0.051	14
824Mo5	1700	3427	0.054	11
824Mo6	1900	3430	0.044	11

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Nitrite* mg/l	Chlorophyll a* mg/m^3
824Ne1	0900	3416	0.11	31
824Ne2	1100	3426	0.113	17
824Ne3	1300	3428	0.072	8.2
824Ne4	1500	3425	0.003	21
824Ne5	1700	3424	0.003	53
824Ne6	1900	3415	L.A.	46

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l
824Mo1	0900	3456	0.30	0.52
824Mo2	1100	3457	0.32	0.36
824Mo3	1300	3461	0.16	0.33
824Mo4	1500	3460	0.46	0.24
824Mo5	1700	3459	0.48	0.18
824Mo6	1900	3458	0.22	0.38

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l
824Ne1	0900	3471	1.6	0.62
824Ne2	1100	3473	0.28	0.96
824Ne3	1300	3483	0.16	0.76
824Ne4	1500	3468	0.22	0.06
824Ne5	1700	3470	0.18	1.0
824Ne6	1900	3478	0.60	1.2

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2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Nitrate * mg/l	TOC * mg/l
824Mo1	0900	3456	0.09	6.4
824Mo2	1100	3457	0.05	19.6
824Mo3	1300	3461	0.05	13.8
824Mo4	1500	3460	0.26	8.5
824Mo5	1700	3459	0.33	9.3
824Mo6	1900	3458	0.06	24.6

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Nitrate * mg/l	TOC * mg/l
824Ne1	0900	3471	0.43	-
824Ne2	1100	3473	0.64	13.6
824Ne3	1300	3483	0.25	16.4
824Ne4	1500	3466	<.02	6.8
824Ne5	1700	3470	<.02	11.9
824Ne5	1900	3478	0.37	14.4

DIFFUSE SOURCE LOAD EVALUATION

Mowrey Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Total* Sulfides
824Mo1	0900	3442	0.37
824Mo2	1100	3440	0.25
824Mo3	1300	3437	0.25
824Mo4	1500	3441	0.25
824Mo5	1700	3434	0.13
824Mo6	1900	3439	0.44

Newark Slough

824Ne1	0900	3439	0.38
824Ne2	1100	3436	0.38
824Ne3	1300	3435	0.51
824Ne4	1500	3444	0.63
824Ne5	1700	3443	1.00
824Ne6	1900	3438	0.51

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Time of Collection	Sample #	D.O. mg/l	Temp. C°	Salinity	p.h.
0900	824Ft1	6.5	21.5	29.5	7.8
1000	824Ft2	8.0	22.5	29.5	L.A.
1100	824Ft3	5.7	22.2	30.2	L.A.
1200	824Ft4	8.4	22.5	30.5	7.4
1300	824Ft5	9.5	23.5	30.0	7.7
1400	824Ft6	9.3	24.0	31.0	7.2
1500	824Ft7	9.0	24.0	31.0	7.3
1600	824Ft8	8.3	25.0	30.0	7.7
1700	824Ft9	9.0	25.0	31.2	7.6
1800	824Ft10	8.4	25.0	30.0	7.3
1900	824Ft11	7.5	24.0	32.0	7.5

L.A. = Laboratory Accident

E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Non* Filtrable Residue mg/1	Filtrable* Residue mg/1	Total* Ortho-PO_4 mg/1
824Ft1	0900	3414	10	37,100	1.2
824Ft2	1000	3411	230	35,400	1.1
824Ft3	1100	3405	150	36,300	1.1
824Ft4	1200	3413	120	40,400	1.2
824Ft5	1300	3417	150	40,500	1.3
824Ft6	1400	3412	82	39,400	1.3
824Ft7	1500	3418	112	35,000	1.4
824Ft8	1600	3420	110	40,000	1.4
824Ft9	1700	3419	310	41,000	1.2
824Ft10	1800	3410	350	36,600	1.1
824Ft11	1900	3421	110	40,500	1.1

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Nitrite* mg/1	Chlorophyll a* mg/m^3
824Ft1	0900	3414	0.019	24.0
824Ft2	1000	3411	0.008	6.1
824Ft3	1100	3405	0.018	3.5
824Ft4	1200	3413	0.060	8.3
824Ft5	1300	3417	0.076	42.0
824Ft6	1400	3412	0.092	7.0
824Ft7	1500	3418	0.090	37.0
824Ft8	1600	3420	0.10	7.8
824Ft9	1700	3419	0.097	9.4
824Ft10	1800	3410	0.045	8.8
824Ft11	1900	3421	0.040	5.6

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
824Ft1	0900	3469	0.60	0.50	0.22	11.8
824Ft2	1000	3472	1.9	0.70	0.33	6.1
824Ft3	1100	3480	0.30	0.38	0.35	6.1
824Ft4	1200	3465	0.40	0.32	0.32	6.7
824Ft5	1300	3464	0.18	0.44	0.47	11.0
824Ft6	1400	3479	1.5	0.42	0.29	13.8
824Ft7	1500	3466	1.1	1.2	0.25	11.7
824Ft8	1600	3474	1.1	0.42	0.26	13.2
824Ft9	1700	3484	0.62	0.50	0.46	14.4
824Ft10	1800	3475	0.38	0.62	0.26	11.0
824Ft11	1900	3476	0.34	0.62	0.25	18.0

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Total* Sulfides mg/l
824Ft1	0900	3445	0.38
824Ft2	1000	3450	0.25
824Ft3	1100	3451	0.28
824Ft4	1200	3446	0.32
824Ft5	1300	3448	0.25
824Ft6	1400	3447	0.18
824Ft7	1500	3452	0.30
824Ft8	1600	3454	0.38
824Ft9	1700	3453	0.14
824Ft10	1800	3455	0.25
824Ft11	1900	3449	0.38

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DIFFUSE SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*.

E.H. Smith & Associates
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Date of Collection 8/24/77

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
824Ne-1	0900	3416	Total	7.0	16	17	17	17	17	17
			Inhibited	9.7	9.7	15	15	15	16	16
824Ne-2	1100	3426	Total	14	16	17	18	18	18	18
			Inhibited	12	16	17	17	17	17	17
824Ne-3	1300	3428	Total	21	20	21	21	20	20	19
			Inhibited	12	22	26	28	30	30	31
824Ne-4	1500	3425	Total	4.0	4.3	4.7	4.7	4.7	4.7	4.7
			Inhibited	2.7	3.2	3.1	3.4	3.8	3.8	3.8
824Ne-5	1700	3424	Total	6.0	41	43	44	45	45	45
			Inhibited	25	28	28	29	31	31	31

DIFFUSE SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

E.H. Smith & Associates
2/1/78-Revision

Date of Collection 8/24/77

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
824Ne-6	1900	3415	Total	24	28	28	30	28	28	30
			Inhibited	7.0	16	17	17	17	17	17
			Mowrey Slough							
824Mo-1	0900	3431	Total	8.8	8.5	8.8	8.5	8.5	8.5	8.2
			Inhibited	5.5	6.4	7.3	7.3	7.3	7.6	7.6
824Mo-2	1100	3429	Total	6.0	8.0	8.0	10	10	10	10
			Inhibited	4.9	5.5	5.5	5.8	6.4	6.7	6.7
824Mo-3	1300	3432	Total	5.8	8.2	9.4	9.1	9.4	9.1	9.4
			Inhibited	7.6	8.2	8.5	8.8	8.8	8.8	8.8

DIFFUSE SOURCE LOADING EVALUATION

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

Date of Collection 8/24/77 Mowrey Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
824Mo-4	1500	3453	Total	L.A.-Laboratory Accident						
			Inhibited	"		"				
824Mo-5	1700	3427	Total	7.3	7.6	7.9	8.8	9.4	9.4	9.7
			Inhibited	4.9	7.9	9.7	9.7	9.1	9.7	9.7
824Mo-6	1900	3430	Total	8.8	12	12	12	12	12	12
			Inhibited	7.3	7.6	8.5	8.8	8.8	10	11

Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
824Ft-1	0900	3414	Total	7.0	8.0	10	10	10	10	10
			Inhibited	4.9	6.1	4	5.5	6.1	6.1	6.1

DIFFUSE SOURCE LOADING EVALUATION

E.H. Smith & Associates
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21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

Date of Collection 8/24/77 Faber Tract Slough

Sample #	Time of Collection	Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
824Ft-2	1000	3411	Total	7.0	7.3	7.0	7.3	7.3	7.3	7.3
			Inhibited	6.4	5.5	6.4	6.7	7.3	7.0	7.3
824Ft-3	1100	3405	Total	8.0	9	10	9	10	9	10
			Inhibited	6.4	6.4	7.3	7.0	7.0	6.7	7.0
824Ft-4	1200	3413	Total	5.4	6.3	6.6	7.0	6.6	6.6	6.6
			Inhibited	4.2	5.4	6.2	6.4	6.6	6.2	6.4
824Ft-5	1300	3417	Total	5.8	10	10	10	10	10	10
			Inhibited	3.8	6.4	9.0	9.6	10	10	10
824Ft-6	1400	3412	Total	6.4	9.0	10	11	11	11	11
			Inhibited	4.4	6.8	8.2	9.2	11	11	12

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DIFFUSE SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

Date of Collection 8/24/77 — Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/1						
824Ft-7	1500	3418	Total	6.0	10	11	11	11	12	11
			Inhibited	4.0	4.8	7.2	9.0	10	11	11
824Ft-8	1600	3420	Total	4.2	6.4	9.0	10	13	13	13
			Inhibited	4.6	7.2	10	12	12	13	12
824Ft-9	1700	3419	Total	8.8	10	11	11	11	11	11
			Inhibited	6.7	6.4	7.0	9.5	9.5	9.5	9.8
824Ft-10	1800	3410	Total	6.4	8.2	8.8	8.8	8.8	8.8	8.8
			Inhibited	4.9	6.1	6.7	7.3	7.3	7.3	7.3
824Ft-11	1900	3421	Total	7.3	7.0	7.3	7.3	7.3	7.3	7.3
			Inhibited	4.6	6.4	6.7	6.7	6.7	6.7	6.7

E.H. Smith & Associates

SLOUGHS-HYDROLOGICAL DATA

Date of Collection 8/24/77

Mowrey Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft^2	Flow Rate cfs.	Tide
0900	4.0	44	50	55	.91	115.5	105.1	Incoming
1100	5.5	51	50	130	.38	186.0	71.5	Outgoing
1300	2.5	34	50	70	.71	56.5	40.4	Outgoing
1500	1.5	26	50	75	.67	26.5	17.8	Outgoing
1700	1.0	18	50	130	.38	13.5	5.13	Incoming
1900	4.0	45	50	70	.71	115.5	82.0	Incoming

Newark Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft^2	Flow Rate cfs.	Tide
0920	5.5	114	30	96	.32	342.0	109.8	Incoming
1120	6.5	120	30	162	.19	462.0	87.8	Outgoing
1320	4.5	104	30	76	.39	231.0	91.2	Outgoing
1520	2.0	52	30	130	.23	49.5	11.4	Outgoing
1720	2.5	60	30	58	.52	72.5	37.5	Incoming
1920	5.5	115	30	50	.60	342.0	205.2	Incoming

E.H. Smith & Associates

SLOUGHS-HYDROLOGICAL DATA

Date of Collection 8/24/77

Faber Tract Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	7.5	71	30	90	.33	319.0	106.33	Incoming
1000	8.5	73	15	40	.38	390.5	146.4	Incoming
1100	9.0	75	30	107	.28	429.0	120.3	Outgoing
1200	7.0	67	15	100	.15	289.5	43.4	Outgoing
1300	5.5	62	15	60	.25	189.5	47.4	Outgoing
1400	5.25	59	15	60	.25	180.8	45.2	Outgoing
1500	5.0	57	15	100	.15	159.5	24.0	Outgoing
1600	4.5	52	15	57	.26	129.5	34.0	Incoming
1700	5.0	57	15	30	.50	159.5	78.0	Incoming
1800	7.0	67	15	20	.75	289.5	217.0	Incoming
1900	9.5	75	15	28	.54	464.0	251.0	Incoming

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection 8/25/77

Sample #	Time of Collection	p.H.	D.O. mg/1	Temp. C°	Salinity † ppt	Tide	Depth	Depth of Sample
825RW-31-I	0845	7.4	8.15	21.0	31.5	Incoming	30'	15
825RW-137-I	0905	8.0	7.9	21.2	30.0	Incoming	8'	4
825RW-20-I	0915	7.4	7.85	21.5	31.5	Incoming	22'	11
825RW8-I	0925	8.0	7.5	21.9	30.0	Incoming	8'	4
825RW-4-I	0940	7.9	3.6	22.0	31.0	Incoming	11'	6
825RW1	0950	7.9	2.2	22.0	19.98*	Incoming	6'	3
825RW-120	1010	7.6	6.0	22.5	29.0	Incoming	12'	6
825RW-133	1210	7.6	7.8	23.5	30.5	Outgoing	10'	5
825RW-128	1225	7.5	8.8	23.5	30.0	Outgoing	5'	3
825RW-123	1245	7.7	8.4	23.0	27.2	Outgoing	15'	7
825RW-4-II	1300	7.6	6.8	24.0	25.0	Outgoing	8'	4
825RW-8-II	1310	7.8	8.9	24.0	30.0	Outgoing	9'	5
825RW-20-II	1330	7.2	8.5	24.0	31.5	Outgoing	18'	9
825RW-126	1330	7.0	4.8	24.0	27.2	Outgoing	5'	3
825RW-137-II	1340	7.8	8.1	23.0	31.1	Outgoing	6'	3
825RW-31-II	1400	7.4	8.5	23.0	32.6*	Outgoing	5'	3

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RECEIVING WATER MONITORING (cont'd)

Sample #	Time of Collection	p.H.	D.O. mg/l	Temp. C°	Salinity† ppt	Tide	Depth	Depth of Sample
825RW-130	1250	7.2	6.05	24.0	30.0	Outgoing	5'	3
825RW-118	1515	6.9	3.3	24.0	29.2	Outgoing	5'	3
825RW-4-III	NOT SAMPLED-POOR WEATHER CONDITIONS							
825RW-8-III	" " " " "							
825RW-20-III	" " " " "							
825RW-137-III	" " " " "							
825RW-31-III	" " " " "							
825RW-109	NOT SAMPLED-STATIONS INACCESSIBLE							
825RW-100	" " " " "							

† VERIFIED BY TITRATION

E.H. Smith & Associates
2/1/78-Revision

RECEIVING WATER MONITORING

Date of Collection 8/25/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
825RW-31-I	0845	3467	0.34	1.0	<0.02	7.8
825RW-137-I	0905	3463	0.32	0.22	<0.02	12.7
825RW-20-I	0915	3485	0.14	0.28	<0.02	13.1
825RW-8-I	0925	3462	0.26	0.30	0.46	8.5
825RW-4-I	0940	3482	2.4	0.38	0.74	10.3
825RW-1	0950	3481	5.2	0.74	0.85	13.8
825RW-120	1010	3477	1.7	0.82	0.61	8.8
825RW-133	1210	3498	0.16	0.02	0.33	8.7
825RW-128	1225	3507	0.22	0.34	0.29	19.9
825RW-123	1245	3506	0.76	0.16	0.68	9.4
825RW-130	1250	3500	0.18	0.02	0.56	12.8
825RW-4-II	1300	3497	0.22	0.42	0.72	7.6
825RW-8-II	1310	3503	0.18	0.02	0.32	15.0
825RW-20-II	1330	3499	0.16	0.32	0.05	12.5
825RW-126	1330	3505	0.24	0.48	0.08	7.2

RECEIVING WATER MONITORING (cont'd)

Date of Collection 8/25/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
825RW-137-II	1340	3501	0.06	0.26	0.26	7.2
825RW-31-II	1400	3504	0.10	0.10	0.07	9.4
825RW-118	1515	3502	1.9	2.6	1.1	10.2

RECEIVING WATER MONITORING

Date of Collection 6/25/77

Sample #	Time of Collection	Laboratory Descriptor	Non * Filtrable Residue mg/l	Filtrable * Residue mg/l	Nitrite* mg/l	Total* Ortho Phosphate mg/l	Chlorophyll a * mg/m^3
825RW-31-I	0845	3423	29	40,000	0.009	0.68	3.2
825RW-137-I	0905	3422	96	38,400	0.017	0.81	2.8
825RW-20-I	0915	3404	59	38,600	0.020	1.8	4.0
825RW-8-I	0925	3409	160	35,600	0.055	1.4	5.1
825RW-4-I	0940	3407	76	28,900	0.084	1.0	7.1
825RW-1	0950	3406	92	21,100	0.67	2.5	19
825RW-120	1010	3408	440	35,000	0.029	0.81	7.7
825RW-133	1210	3491	56	38,300	0.030	0.83	5.8
825RW-128	1225	3490	88	38,500	0.079	1.2	9.9
825RW-123	1245	3488	11	34,300	0.22	1.5	16
825RW-130	1250	3494	70	34,000	0.092	2.0	15
825RW-4-II	1300	3489	81	33,300	0.34	1.6	11
825RW-8-II	1310	3493	49	38,500	0.059	1.0	6.7
825RW-20-II	1330	3487	45	39,000	-0.015	0.68	2.8
825RW-126	1330	3495	74	36,500	0.045	1.1	1.1

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RECEIVING WATER MONITORING (cont'd)

Date of Collection 8/25/77

Sample #	Time of Collection	Laboratory Descriptor	Non * Filtrable Residue mg/l	Filtrable * Residue mg/l	Nitrite * mg/l	Total * Ortho Phosphate mg/l	Chlorophyll a * mg/m^3
825RW-137-II	1340	3492	70	25,900	0.024	0.81	5.7
825RW-31-II	1400	3486	68	40,300	0.011	0.67	6.0
825RW-118	1515	3496	61	25,300	2.1	2.1	10

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21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection 8/25/77

Receiving Water

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
825Rw-31-I	0845	3423	Total	<0.05	0.5	0.7	0.6	0.9	1.0	1.0
			Inhibited	<0.05	0.1	0.1	0.2	0.3	0.2	0.3
825Rw-137-I	0905	3422	Total	0.5	0.9	1.0	1.2	1.4	1.3	1.3
			Inhibited	<0.05	0.2	0.5	0.5	0.5	0.5	0.5
825Rw-20-I	0915	3404	Total	0.1	0.8	1.1	1.3	1.3	1.5	1.5
			Inhibited	1.5	1.5	1.5	1.5	1.5	1.5	1.5
825Rw8-I	0925	3409	Total	2.2	4.1	4.2	4.5	4.5	4.5	4.4
			Inhibited	2.0	2.9	3.8	4.0	4.3	4.4	4.4
825Rw-4-I	0940	3407	Total	10	12	11	12	12	12	12
			Inhibited	5.8	10	13	14	14	14	14

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21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

Date of Collection 8/25/77 **Receiving Water**

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
825Rw-1	0950	3406	Total	9.1	15	22	25	26	26	27
			Inhibited	8.5	15	19	23	25	26	27
825Rw-120	1010	3408	Total	1.6	1.9	2.6	2.7	2.9	3.1	3.2
			Inhibited	5.5	6.1	6.7	7.3	7.3	7.3	7.3
825Rw-133	1210	3491	Total	L.A. - Laboratory Accident						
			Inhibited	17	17	17	17	17	17	17
825Rw-128	1225	3490	Total	5.0	6.2	6.8	6.4	6.4	6.4	6.6
			Inhibited	4.4	5.4	5.6	5.4	5.6	6.0	6.2
825Rw-123	1245	3488	Total	7.9	9.7	10	11	11	11	11
			Inhibited	6.3	6.7	8.5	9.7	9.7	9.4	9.7

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21 DAY BIOCHEMICAL OXYGEN DEMAND *(cont'd)

Date of Collection 8/25/77 **Receiving Water**

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
825Rw-130	1250	3494	Total	30	30	31	30	30	31	31
			Inhibited	23	26	27	30	30	30	30
825Rw4-II	1300	3489	Total	6.1	9.4	12	13	15	15	15
			Inhibited	8.8	12	12	13	13	13	13
825Rw-8-II	1310	3493	Total	5.4	5.4	6.0	4.8	6.0	5.8	6.0
			Inhibited	4.0	4.0	5.0	6.0	6.0	6.0	6.0
825Rw20-I'	1330	3487	Total	18	17	17	17	18	17	16
			Inhibited	17	16	17	16	15	16	15
825Rw-126	1336	3495	Total	24	24	25	26	25	25	25
			Inhibited	4.6	7.7	8.5	8.2	8.5	8.5	8.5

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21 DAY BIOCHEMICAL OXYGEN DEMAND*(cont'd)

Date of Collection 8/25/77

Receiving Water

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/1						
825Rw-137-II	1340	3492	Total	3.4	3.2	3.2	3.4	3.8	3.8	3.8
			Inhibited	2.8	4.2	4.6	5.0	5.0	4.8	5.0
825Rw-31-II	1400	3486	Total	4.8	5.0	4.8	4.6	4.8	4.8	4.8
			Inhibited	3.6	3.6	3.6	3.4	3.5	4.0	4.0
825Rw-118	1515	3496	Total	12	17	22	22	23	24	24
			Inhibited	10	15	21	24	25	26	26

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Sample Composition Data

8/23-24/77

Source: Union Newark

Sample #	Date	Time of Collection	P.H.	Temp C°	D.O. mg/1	Flow Rate(MGD)
823U-N-1	8/23	1530	7.43	25.0	0.0	2.0
823U-N-2	8/23	2000	N.S.	N.S.	N.S.[1]	6.1
823U-N-3	8/23	2359	N.S	N.S	N.S	6.2
824U-N-4	8/24	0400	N.S	N.S	N.S	2.6
824U-N-5	8/24	0800	7.49	23.0	0.0	6.7
824U-N-6	8/24	1200	7.42	26.0	0.0	6.1

1 - N.S. NOT SUBMITTED

Source: San Jose

Sample #	Date	Time of Collection	P.H.	Temp C°	D.O. mg/1	Flow Rate(MGD)
823SJ-1	8/23	1600	7.0	28.0	4.2	120
823SJ-2	8/23	2000	7.0	29.0	4.2	110
823SJ-3	8/23	2359	7.2	28.5	4.6	122
824SJ-4	8/24	0400	7.4	28.0	4.4	80
824SJ-5	8/24	0800	7.4	[illegible].0	4.2	45
824SJ-6	8/24	1200	7.2	28.0	4.4	115

Source: Palo Alto

Sample #	Date	Time of Collection	P.H.	Temp C°	D.O. mg/1	Flow Rate(MGD)
823Pa-1	8/23	1530	7.0	27.0		26
823Pa-2	8/23	2000	6.9	26.0	3.7	19
823Pa-3	8/23	2359	7.1	26.0	4.0	24
824Pa-4	8/24	0400	6.9	26.0	4.8	14
824Pa-5	8/24	0800	6.3	26.0	5.8	12
824Pa-6	8/24	1200	7.0	26.0	3.1	28

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Sample Composition Data

Source: Union Irvington

Sample #	Date	Time of Collection	Laboratory Descriptor	P.H	Temp C°	mg/1	Flow Rate (MGD)
824U-Ir-1	8/23	1530	-	7.7	25.0	1.2	6.9
824U-Ir-2	8/23	1930	3387	N.S.	N.S.	N.S.	N.S.
824U-Ir-3	8/23	2330	3389	"	"	"	"
824U-Ir-4	8/24	0330	3390	"	"	"	"
824U-Ir-5	8/24	0730	-	7.4	24.0	2.0	1.8
824U-Ir-6	8/24	1200	-	7.3	25.0	1.3	7.0

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2/1/78-Revision

POINT SOURCE LOADING EVALUATION

Date of Collection 8/23-24/77

Type of Sample: Composite

Sample #	Source	Filtrable* Residue mg/1	Non-* Filtrable Residue mg/1	Nitrite* mg/1	Total* Ortho PO_4 mg/1	Ammonia* Nitrogen mg/1	Organic* Nitrogen mg/1	Nitrate* mg/1	TOC* mg/1
82324Sj	San Jose	1,880	34	0.30	5.2	14.5	5.2	0.40	27.8
82324Pa	Palo Alto	2,690	16	<0.002	7.0	12.3	3.1	0.04	12.3
82324U-N	Newark	9,770	19	0.003	11	35	11	<0.02	14.7
82324U-Ir	Irvington	7,780	72	0.003	12	45	13	0.16	26.5

Note: Due to a lack of flow data, the representative sample from Union-Irvington was composited from only three discrete samples for the 24 hour period.

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E.H. Smith & Associates
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POINT SOURCE LOADING EVALUATION

Date of Collection 8/23-24/77
Source: Union Irvington
Type of Sample: Individual

Sample # (Descriptor)	Time	Filtrable* Residue mg/l	Non-* Filtrable Residue mg/l	Nitrite* mg/l	Total* ortho PO_4 mg/l	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
823U-Ir2 (3387)	1930	3,030	130	0.063	1.3		NO DATA DUE TO		
823U-Ir3 (3389)	2330	7,620	83	0.012	1.3		INSUFFICIENT SAMPLE VOLUME		
824U-Ir4 (3390)	0330	2,930	76	0.009	1.3				

E.H. Smith & Associates
2/1/78-Revision

POINT SOURCE LOADING EVALUATION

21 Day Biochemical Oxygen Demand*

Date of Collection 8/23-24/77

Sample #	Source	Sample Type	Monitoring Interval (Days)	3	6	9	12	15	18	21
							B.O.D. mg/l			
82324U-N	Union Newark	Composite of 6	Total	170	510	600	660	680	700	690
			Inhibited	180	510	540	570	590	610	620
82324SJ	San Jose	Composite of 6	Total	190	410	450	460	470	470	470
			Inhibited	120	320	340	330	340	340	340
82324PA	Palo Alto	Composite of 6	Total	320	620	700	750	820	850	860
			Inhibited	280	290	300	300	300	300	300
82324U-Ir	Union Irvington	Composite of 3	Total	240	310	340	380	370	380	380
			Inhibited	120	180	220	230	240	240	240

E. H. Smith & Associates
Biological Consultants

4090 Harrison Grade Rd
Sebastopol, Ca. 95472
(707) 874-3108

November 2, 1977

Dr. C.M. Harper
Environmental Services Dept.
Bechtel Incorporated
P.O. Box 3965
San Francisco, Ca. 94119

Dear Carol:

Enclosed is the data for the second sampling effort for the South Bay project. The chemical assays for the third sampling effort are still being processed by the water quality laboratory, and the data will be forewarded to you after transcription of the data is completed.

Any questions concerning the data should be accompanied by both the sampling number and laboratory descriptor.

Sincerely,

William H Rotz
William G. Rotz

enc:

E.H. Smith & Associates
2/1/78-Revision

POINT SOURCE LOADING EVALUATION

21 Day Biochemical Oxygen Demand*
Individual Samples

Date of Collection 8/23-24/77

Sample # (Descriptor)	Source	Time of Collection	Monitoring Interval (Days)	3	6	9	12	15	18	21
				B.O.D. mg/l						
823U-Ir2 (3387)	Union Irvington	1930	Total	290	300	290	290	300	300	300
			Inhibited	130	180	200	200	200	200	200
823U-Ir3 (3389)	Union Irvington	2330	Total	260	320	310	300	330	320	310
			Inhibited	210	260	270	280	290	280	290
824U-Ir4 (3390)	Union Irvington	0330	Total	310	310	320	310	310	310	310
			Inhibited	90	180	200	240	250	260	260

Introduction

The samples for this effort were collected during the period of 9/13-15/77. Collection methods, preservation, and assay of samples were conducted as described in the first South Bay Report. D.O., temperature, pH, and salinity were measured "in situ" by E.H. Smith & Associates. The parameters denoted by an asterisk (*) were assayed by the Pacific Marine Station Water Quality Laboratory. Information pertaining to sampling for each source evaluation is discussed below under the appropriate section.

Diffuse Source Loading Evaluation

Samples for diffuse source evaluation were collected on 9/14/77. The labeling system for the slough samples is as follows:

914Mo-1-6
914NE-1-6
914FT-1-6

The first three digits refer to the date of collection; the letters code for the location (Mowry, Newark, or Faber Tract); the numbers denote the order of sampling.

Receiving Water Monitoring

Sampling of the receiving water stations were collected on 9/14/77. Sample numbers include the date of collection, station grid number, and the number or times the grid was sampled. Station 31-III was not sampled due to poor weather conditions. Because of inaccesibility, station 100 could not be sampled.

Point Source Loading Evaluation

Data for the point source evaluation is incomplete. Samples from the Union-Newark and San Jose facilities were composited from flow data and assayed as a single sample. The samples from Sunnyvale were composited at the facility and were submitted as a single representative. Because of a lack of flow data, samples from Palo Alto and Union-Irvington had to be assayed individually. A number of these samples were improperly preserved and could not be assayed. The deletions are denoted by "N.D." (No Datum). Among these are included data for ammonia nitrogen, organic nitrogen, nitrate, and TOC from samples collected at the Union-Irvington facility. The labeling scheme for the samples includes the date of collection, letter code for the treatment facility, and order of sample collection (where applicable).

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection 9/14/77

Time of Collection	Sample #	D.O. mg/l	Depth[1] ft.	Temp. C°	Salinity ppt	pH
1000	914Mo-1	3.4	.5	19.0	+19.0	7.0
1200	914Mo-2	3.4	2.0	19.0	+22.0	7.0
1400	914Mo-3	3.4	3.0	19.0	29.0	7.5
1600	914Mo-4	3.6	2.0	19.0	26.5	7.1
1800	914Mo-5	4.6	2.0	19.0	26.5	7.1
2000	914Mo-6	4.6	1.5	19.0	+21.5	7.2

Newark Slough

Time of Collection	Sample #	D.O. mg/l	Depth[1] ft.	Temp. C°	Salinity ppt	pH
1030	914Ne-1	6.5 6.0	.5 1.5	18.5	32.0	7.1
1200	914Ne-2	5.6	.5	19.0	32.0	7.2
1400	914Ne-3	1.0	.5	19.9	29.8	7.4
9600	914Ne-4	1.8	.5	20.0	30.0	7.4
1800	914Ne-5	5.8	.5	19.5	30.5	7.5
2000	914Ne-6	6.2	.5	19.5	32.5	6.9

+ Verified by Titration

[1] Depth of D.O. measurement

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 9/14/77

Time of Collection	Sample #	D.O. mg/l	Depth[1] ft.	Temp. C°	Salinity ppt	pH
1000	914Ft-1	3.8	1.0	18	29.0	7.5
1100	914Ft-2	5.9	2.0	19.8	29.5	7.4
1200	914Ft-3	7.5	3.0	20.5	28.0	7.0
1300	914Ft-4	7.8	4.0	21.0	30.2	6.8
1400	914Ft-5	7.5	4.5	21.0	31.0	7.1
1500	914Ft-6	7.8	4.5	21.0	29.5	7.0
1600	914Ft-7	10.0	4.0	21.5	30.2	7.2
1700	914ft-8	11.0	3.5	21.5	30.0	7.2
1800	914Ft-9	10.6	2.5	21.0	29.0	6.9
1900	914Ft-10	9.3	1.5	20.1	31.0	7.2
2000	914Ft-11	8.2	1.0	19.2	29.0	7.5

[1] Depth of D.O. measurement

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
914Mo-1	1000	3592	0.64	1.3	0.65	41
914Mo-2	1200	3594	0.54	0.32	0.67	9.9
914Mo-3	1400	3595	0.54	0.66	0.55	5.2
914Mo-4	1600	3590	0.52	0.28	0.66	3.6
914Mo-5	1800	3596	0.50	1.3	0.63	30
914Mo-6	2000	3597	0.58	0.44	0.71	12.3

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
914Ne-1	1030	3600	0.40	0.90	0.79	19
914Ne-2	1200	3718	0.38	0.54	0.62	9.1
914Ne-3	1400	3717	1.1	0.46	0.64	4.7
914Ne-4	1600	3601	1.0	0.50	0.46	13
914Ne-5	1800	3599	0.32	1.3	0.54	46
914Ne-6	2000	3589	0.28	0.92	0.58	24

* Assay performed by Pacific Marine Station Water Quality Laboratory

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DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro- * phyll-a mg/m^3
914Mo-1	1000	3604	550	22,020	0.54	0.033	1.4
914Mo-2	1200	3605	470	25,700	0.43	0.094	9.0
914Mo-3	1400	3609	364	36,300	1.0	0.078	3.9
914Mo-4	1600	3602	267	34,100	0.95	0.114	5.2
914Mo-5	1800	3603	266	31,580	0.70	0.12	L.A.
914Mo-6	2000	3610	141	25,600	0.80	0.045	9.0

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro- * phyll-a mg/m^3
914Ne-1	1030	3617	120	39,200	2.1	0.119	15
914Ne-2	1200	3619	150	33,700	1.8	0.161	-
914Ne-3	1400	3622-A	28	33,800	2.1	0.060	0.5
914Ne-4	1600	3621	356	35,500	1.6	0.20	4.5
914Ne-5	1800	3620	35.6	37,600	1.8	0.13	1.5
914Ne-6	2000	3618	303	37,600	2.0	0.092	9.5

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
914Ft-1	1000	3585	0.84	1.1	0.46	26
914Ft-2	1100	3583	0.90	0.66	0.67	19
914Ft-3	1200	3586	0.48	0.78	0.56	32
914Ft-4	1300	3584	0.18	0.24	0.53	6.3
914Ft-5	1400	3581	0.18	0.36	0.44	10
914Ft-6	1500	3587	0.30	0.36	0.46	5.4
914Ft-7	1600	3591	0.50	0.42	0.54	7.9
914Ft-8	1700	3588	0.28	0.66	0.58	7.1
914Ft-9	1800	3593	0.36	0.46	0.43	10.2
914Ft-10	1900	3582	0.40	0.54	0.36	11
914Ft-11	2000	3598	0.54	1.1	0.64	30

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DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro- * phyll-a mg/m^3
914Ft-1	1000	3623	102	34,980	0.81	0.082	9.1
914Ft-2	1100	3615	110	26,000	0.82	0.089	2.0
914Ft-3	1200	3622	28	33,800	2.1	0.060	<0.5
914Ft-4	1300	3608	98	35,000	0.54	0.041	2.9
914Ft-5	1400	3607	249	34,500	0.43	0.029	L.A.
914Ft-6	1500	3614	296	35,000	0.48	0.029	1.1
914Ft-7	1600	3611	32.0	34,600	0.54	0.05	3.8
914Ft-8	1700	3606	21.3	34,800	0.55	<0.002	1.9
914Ft-9	1800	3613	106	36,560	0.58	0.061	2.2
914Ft-10	1900	3612	300	33,700	0.54	0.062	11
914Ft-11	2000	3616	82	35,400	0.54	0.059	2.8

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Sulfides mg/l
914Mo-1	1000	3834	0.15
914Mo-2	1200	3832	0.00
914Mo-3	1400	3931	0.05
914Mo-4	1600	3835	0.45
914Mo-5	1800	3830	0.00
914Mo-6	2000	3833	0.25

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Total * Sulfides mg/l
914Ne-1	1030	3837	0.25
914Ne-2	1200	3836	0.40
914Ne-3	1400	3838	0.52
914Ne-4	1600	3839	0.63
914Ne-5	1800	3840	0.45
914Ne-6	2000	3841	0.07

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection. 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Sulfides mg/l
914Ft-1	1000	3824	1.39
914Ft-2	1100	3825	0.91
914Ft-3	1200	3823	1.36
914Ft-4	1300	3826	0.95
914Ft-5	1400	3822	0.38
914Ft-6	1500	3827	1.12
914Ft-7	1600	3821	0.43
914Ft-8	1700	3828	0.75
914Ft-9	1800	3820	0.31
914Ft-10	1900	3829	0.46
914Ft-11	2000	3819	1.05

DIFFUSE SOURCE LOAD EVALUATION   E.H. Smith & Associates

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 9/14/77   Mowry Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Mo-1	1000	3604	Total	1.2	3.2	5.5	7.1	8.6	9.0	12
			Inhibited	1.4	1.6	3.8	5.0	6.2	7.0	12
914Mo-2	1200	3605	Total	0.5	2.6	4.7	5.8	7.4	14	20
			Inhibited	1.5	2.5	3.[illegible]	4.7	6.5	7.0	9.0
914Mo-3	1400	3609	Total	0.9	1.9	3.3	4.9	6.5	7.1	7.4
			Inhibited	1.0	1.5	1.9	3.0	4.7	5.9	7.1
914Mo-4	1600	3602	Total	1.0	2.1	3.7	5.1	6.4	11	11
			Inhibited	0.4	1.6	3.2	4.6	5.7	8.0	11
914Mo-5	1800	3603	Total	1.0	2.3	4.0	5.7	6.8	7.4	12
			Inhibited	0.5	1.6	2.7	3.6	5.9	6.9	10
914Mo-6	2000	3610	Total	0.1	1.5	3.2	4.6	5.8	6.8	7.9
			Inhibited	0.1	0.9	2.0	3.7	5.0	5.5	6.4

DIFFUSE SOURCE LOADING EVALUATION   E.H. Smith & Associates

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/14/77   Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ne-1	1030	3617	Total	1.6	5.6	7.3	16	18	23	28
			Inhibited	0.8	3.5	6.2	9.0	12	14	22
914Ne-2	1200	3619	Total	0.9	4.2	6.9	12	14	18	22
			Inhibited	1.0	3.9	5.0	7.0	9.0	11	14
914Ne-3	1400	3622	Total	0.9	1.9	2.9	5.0	7.8	8.0	11
			Inhibited	0.9	1.9	2.9	4.9	7.9	8.0	12
914Ne-4	1600	3621	Total	0.8	3.5	5.2	7.2	9.0	13	17
			Inhibited	0.5	2.9	4.0	5.7	8.0	12	18
914Ne-5	1800	3620	Total	0	10	17	20	23	24	24
			Inhibited	2.0	6.0	12	16	17	20	19
914Ne-6	2000	3618	Total	1.3	6.7	8.5	18	20	20	20
			Inhibited	1.1	5.0	7.8	8.0	10	9.0	11

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DIFFUSE SOURCE LOADING EVALUATION E.H. Smith & Associates

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/14/77 Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ft-7	1600	3611	Total	0.6	1.9	3.0	3.9	4.6	5.5	6.3
			Inhibited	0.1	1.2	2.5	3.8	4.6	5.4	5.4
914Ft-8	1700	3606	Total	1.3	2.5	3.4	4.3	5.3	6.5	7.4
			Inhibited	1.4	2.6	3.3	4.4	5.2	6.0	7.4
914Ft-9	1800	3613	Total	1.5	3.1	4.3	5.7	7.6	8.6	9.0
			Inhibited	1.5	2.5	4.4	6.3	8.6	10	
914Ft-10	1900	3612	Total	1.1	2.4	3.0	4.0	5.8	6.6	8.4
			Inhibited	1.1	2.4	3.0	4.0	5.8	6.6	8.4
914Ft-11	2000	3616	Total	0.7	2.4	4.2	6.2	7.7	9.0	14
			Inhibited	0.3	1.8	4.4	5.5	6.3	8.0	10

DIFFUSE SOURCE LOADING EVALUATION E.H. Smith & Associates

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/14/77 Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ft-1	1000	3623	Total	0.5	2.1	4.2	13	15	16	16
			Inhibited	1.5	3.1	4.3	5.7	7.6	8.6	9.0
914Ft-2	1100	3615	Total	0.8	2.1	4.2	7.0	7.0	8.0	12
			Inhibited	0.8	2.0	4.2	6.9	6.0	8.0	12
914Ft-3	1200	3622	Total	0.9	1.9	2.3	5.0	7.8	8.0	11
			Inhibited	0.9	1.9	2.9	4.9	7.9	8.0	12
914Ft-4	1300	3608	Total	0	7.0	13	18	19	23	28
			Inhibited	1.0	6.0	11	15	16	17	18
914Ft-5	1400	3607	Total	0.8	1.4	2.0	2.6	3.6	5.0	6.9
			Inhibited	0.6	1.0	1.4	2.5	2.8	3.4	4.4
914Ft-6	1500	3614	Total	0.8	1.6	2.5	3.2	3.9	4.7	5.7
			Inhibited	0.7	1.2	1.4	2.2	3.2	4.5	5.2

SLOUGHS-HYDROLOGICAL DATA

Newark Slough

Date of Collection: 9/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
1030	2.5	32	20	20	1	43.5	44	Incoming
1200	4.5	84	30	35	.86	170.5	147	Incoming
1400	7.5	122	30	50	.60	502	301	Incoming
1600	7.0	120	30	65	.46	441	203	Outgoing
1800	3.5	60	30	41	.73	95	70	Outgoing
2000	2.0	21	30	39	.77	23	18	Outgoing

Mowry Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
1000	1.5	24	50	105	.48	23	11.04	Incoming
1200	4.5	48	50	40	1.25	135.5	169.4	Incoming
1400	8.5	65	50	150	.33	353.5	116.7	Incoming
1600	7.5	59	50	40	1.25	291.0	363.8	Outgoing
1800	5.0	48	50	60	.83	159.0	132	Outgoing
2000	2.5	34	50	65	.77	55.0	42.3	Outgoing

SLOUGHS-HYDROLOGICAL DATA

Faber Tract Slough

Date of Collection: 9/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Rate cfs.	Tide
1000	2.5	13	16	20	.8	17	14	Incoming
1100	4.5	40	16	14	1.14	51	58	Incoming
1200	5.5	60	15	13	1.23	125	154	Incoming
1300	8.0	70	32	15	2.13	285	607	Incoming
1400	10.0	78	32	34	.94	427	401	Incoming
1500	10.0	78	32	32	1.0	427	427	Outgoing
1600	8.0	70	32	16	2.0	285	570	Outgoing
1700	6.5	65	32	38	.84	194	163	Outgoing
1800	4.5	40	32	52	.62	51	32	Outgoing
1900	3.0	18	16	30	.53	24.5	13	Outgoing
2000	2.5	13	16	60	.27	17	5	Outgoing

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E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 9/15/77

Sample #	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft.
915RW31-I	1100	7.6	5.9	20.5	30.0	30	Incoming	15
915RW137-II	1120	7.5	5.8	20.1	28.1	6	Incoming	3
915RW20-I	1125	7.5	5.8	20.0	30.5	20	Incomign	10
915RW8-I	1135	6.9	5.4	20.0	28.0	20	Incoming	10
915RW4-I	1150	7.8	1.5	19.5	21.0	6	Incoming	3
915RW31-II	1335	7.4	6.0	20.5	29.7	30	Incoming	15
915RW137-II	1347	7.4	6.0	20.5	30.0	10	Incoming	5
915RW20-II	1355	7.8	6.2	20.5	30.0	25	Incoming	12
915RW8-II	1425	7.5	6.2	20.5	28.8	20	Incoming	10
915RW4-II	1500	7.5	4.3	20.0	26.5	10	Incoming	5
915RW128	1415	7.2	6.0	20.5	28.0	10	Incoming	5
915RW123	1435	6.9	5.0	20.0	26.5	10	High Slack	5
915RW1	1450	7.1	3.2	20.0	21.5	15	Outgoing	7
915RW120	1507	7.4	5.4	20.0	27.5	15	Outgoing	7
915RW137-III	1730	6.8	6.4	20.0	29.5	10	Outgoing	5
915RW20-III	1720	7.6	6.2	20.0	29.0	20	Outgoing	10

E.H. Smith & Associates

RECEIVING WATER MONITORING (cont'd)

Date of Collection: 9/15/77

Sample	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft
915RW8-III	1740	7.6	5.8	20.0	28.0	25	Outgoing	12
915RW4-III	1800	7.8	2.6	20.0	22.5	10	Outgoing	5
915RW100	NOT SAMPLED							
915RW31-III	" "							
915RW118	1530	7.3	1.2	19.0	18.0	5	Outgoing	3
915RW104	1600	7.2	4.5	26.5	1.0	4	Outgoing	2
915RW126	1500	7.5	4.7	19.2	27.2	4	Outgoing	2
915RW130	1400	7.3	1.2	20.0	27.0	5	Outgoing	2
915RW133	1400	7.7	6.2	20.0	28.2	10	Outgoing	5

E.H. Smith & Associates
2/1/78-Re

RECEIVING WATER MONITORING

Date of Collection: 9/15/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
915RW-31-I	1100	3733	0.18	0.44	0.46	13
915RW-137-I	1120	3725	0.22	0.32	0.46	3.7
915RW-20-I	1125	3735	0.20	0.46	1.0	14.8
915RW-8-I	1135	3736	0.40	0.62	0.35	12
915RW-4-I	1150	3734	2.2	0.46	0.20	6.3
915RW-31-II	1335	3729	0.16	0.16	0.13	4.0
915RW-137-II	1347	3728	0.20	0.22	0.40	3.1
915RW-29-II	1355	3726	0.10	0.20	0.21	5.6
915RW-8-II	1425	3727	0.14	0.20	0.48	5.5
915RW-4-II	1500	3737	0.48	0.28	0.59	5.6
915RW-128	1415	3782	L.A.	L.A.	L.A.	L.A.
915RW-123	1435	3730	0.62	0.38	0.10	4.8
915RW-1	1450	3731	0.06	0.48	0.63	12
915RW-120	1507	3719	0.30	0.76	0.62	7.0
915RW-137-III	1730	3742	0.08	0.24	0.35	6.0
915RW-20-III	1720	3741	0.10	0.40	0.20	13
915RW-8-III	1740	3738	0.16	0.26	0.73	9.6
915RW-4-II	1800	3740	2.0	0.40	0.90	17
915RW-118	1530	3721	0.74	0.34	1.4	6.3
915RW-104	1600	3724	2.0	2.7	0.48	30
915RW-126	1500	3723	0.40	0.48	0.61	3.4
915RW-130	1400	3720	1.4	0.70	0.62	12
915RW-133	1400	3739	0.16	0.40	0.44	8.9

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 9/15/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Filtrable Residue mg/l	Non- * Filtrable Residue mg/l	Chloro- * phyll-a mg/m^3	Total * Ortho-PO$_4$ mg/l	Nitrite * g/l
915RW-31-I	1100	3754	37,500	100	2.0	0.76	0.019
915RW-137-I	1120	3749	34,000	102	2.0	0.48	0.034
915RW-20-I	1125	3751	35,100	36	0.9	0.98	0.20
915RW-8-I	1135	3747	36,200	80	3.9	1.2	0.014
915RW-4-I	1150	3744	35,000	100	4.0	1.9	0.21
915RW-31-II	1335	3764	35,140	91	3.0	0.78	0.017
915RW-137-II	1347	3756	36,800	145	2.7	0.74	0.19
915RW-20-II	1355	3752	34,700	48	0.5	0.79	0.017
915RW-8-II	1425	3746	33,600	28	3.9	0.88	0.023
915RW-4-II	1500	3757	32,300	35	2.5	1.4	0.11
915RW-128	1415	3743	34,900	31	1.0	1.1	0.052
915RW-123	1435	3753	32,800	32	0.8	0.81	0.023
915RW-1	1450	3750	32,700	21.6	3.2	1.6	0.037
915RW-120	1507	3758	33,900	28	0.5	1.2	0.043

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E.H. Smith & Associates

RECEIVING WATER MONITORING (cont'd)

Date of Collection: 9/15/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Filtrable Residue mg/1	Non-* Filtrable Residue mg/1	Chloro-* phyll-a mg/m^3	Total * Ortho-PO_4 mg/1	Nitrite * mg/1
915RW-137-III	1730	3761	35,700	25	2.2	0.28	0.007
915RW-20-III	1720	3755	37,300	40	1.8	0.30	0.12
915RW-8-III	1740	3748	35,600	10.4	1.2	1.0	0.017
915RW-4-III	1800	3759	35,880	34	0.6	1.9	0.058
915RW-118	1530	3763	36,900	10	3.2	1.6	1.5
915RW-104	1600	3762	35,620	29	0.9	0.15	1.3
915RW-126	1500	3760	36,600	44	3.1	0.93	0.088
915RW-130	1400	3722	L.A.	L.A.	L.A.	L.A.	L.A.
915RW-133	1400	3745	36,100	57	3.1	0.38	0.019

* Assay performed by Pacific Marine Station Water Quality Laboratory

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RECEIVING WATER MONITORING

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND *

Date of Collection: 9/15/77

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Time of Collection	Laboratory Descriptor	Total	0.8	1.4	2.2	2.6	2.7	2.8	3.7
915RW-31-I	1100	3754	Inhibited	0.8	1.4	2.1	2.6	2.9	3.0	3.2
915RW-137-I	1120	3749	Total	0.2	0.9	1.7	1.8	3.3	4.0	5.7
			Inhibited	0.1	0.9	1.3	1.9	2.7	3.6	5.0
915RW-20-I	1125	3751	Total	0.0	0.5	1.2	1.8	2.4	2.9	4.3
			Inhibited	0.1	0.2	0.7	1.6	2.1	3.0	3.1
915RW-8-I	1135	3747	Total	0.2	1.0	2.0	2.8	3.6	5.3	5.3
			Inhibited	0.0	0.8	1.6	1.8	2.9	4.3	5.3
915RW-4-I	1150	3744	Total	0.5	2.5	6.1	12	17	18	20
			Inhibited	0.3	1.8	5.9	6.0	8.0	12	13
915RW-31-II	1335	3764	Total	0.6	1.0	1.9	2.4	2.6	3.0	3.0
			Inhibited	0.2	0.7	1.4	1.7	1.9	2.2	2.2

RECEIVING WATER MONITORING E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/15/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
915RW-137-II	1347	3756	Total	0.3	0.8	1.4	2.2	2.2	2.3	3.2
			Inhibited	0.2	0.5	1.1	1.7	1.8	2.4	2.6
915RW-20-II	1355	3752	Total	0.5	0.6	1.3	2.1	2.4	2.6	3.1
			Inhibited	0.5	0.6	1.0	1.8	2.0	2.4	2.4
915RW-8-II	1425	3746	Total	0.2	0.7	1.6	2.4	2.9	3.6	4.4
			Inhibited	0.3	0.4	0.6	1.7	2.1	2.6	3.1
915RW-4-II	1500	3757	Total	0.3	1.2	2.9	4.4	6.2	7.2	8.4
			Inhibited	0.3	1.2	2.5	3.7	4.6	5.7	7.1
915RW-128	1415	3743	Total	0.2	1.1	2.1	3.1	3.0	4.2	5.3
			Inhibited	0.2	0.8	1.3	2.0	2.3	3.0	3.5
915RW-123	1435	3753	Total	0.8	2.3	3.7	5.4	7.0	8.3	8.7
			Inhibited	0.9	2.1	3.3	4.9	5.9	7.6	8.3

RECEIVING WATER MONITORING E.H. Smith & Associates

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/15/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
915RW-1	1450	3750	Total	0.6	1.7	4.4	6.6	8.0	7.9	10
			Inhibited	0.4	0.8	2.5	6.0	7.4	7.7	9
915RW-120	1507	3758	Total	0.0	0.6	1.6	2.9	4.0	5.1	6.6
			Inhibited	0.0	0.2	2.4	3.4	5.0	5.1	5.3
915RW-137-III	1730	3761	Total	0.0	0.7	1.7	2.6	4.0	4.0	5.9
			Inhibited	0.0	0.7	1.6	2.7	2.7	2.8	2.9
915RW-20-III	1720	3755	Total	0.6	1.0	1.8	2.3	2.3	2.5	3.4
			Inhibited	0.9	1.5	1.6	2.2	2.7	2.7	2.7
915RW-8-III	1740	3748	Total	0.6	1.7	2.6	3.5	3.9	5.1	6.0
			Inhibited	0.5	1.5	2.2	2.9	3.3	3.9	5.2
915RW-4-III	1800	3759	Total	1.4	3.7	7.4	16	23	28	29
			Inhibited	1.2	1.6	1.8	1.8	1.9	1.9	1.9

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DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

E.H. Smith & Associates
2/1/78-Revision

Date of Collection: 9/14/77 Mowry Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Mo-1	1000	3604	Total	1.2	3.2	5.5	7.1	8.6	9.0	12
			Inhibited	1.4	1.6	3.8	5.0	6.2	7.0	12
914Mo-2	1200	3605	Total	0.5	2.6	4.7	5.8	7.4	14	20
			Inhibited	1.5	2.5	3.9	4.7	6.5	7.0	9.0
914Mo-3	1400	3609	Total	0.9	1.9	3.3	4.9	6.5	7.1	7.4
			Inhibited	1.0	1.5	1.9	3.9	4.7	5.9	7.1
914Mo-4	1600	3602	Total	1.0	2.1	3.7	5.1	6.4	11	11
			Inhibited	0.4	1.6	3.2	4.6	5.7	8.0	11
914Mo-5	1800	3603	Total	1.0	2.3	4.0	5.7	6.8	7.4	12
			Inhibited	0.5	1.6	2.7	3.6	5.3	6.9	10
914Mo-6	2000	3610	Total	0.1	1.5	3.2	4.6	5.8	6.8	7.9
			Inhibited	0.1	0.9	2.0	3.7	5.0	5.5	6.4

I-9-Re

DIFFUSE SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

E.H. Smith & Associates
2/1/78-Revision

Date of Collection: 9/14/77 Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ne-1	1030	3617	Total	1.6	5.6	7.3	16.	18	23	28
			Inhibited	0.8	3.5	6.2	9.0	12	14	22
914Ne-2	1200	3619	Total	0.8	4.2	6.9	12	14	18	22
			Inhibited	1.0	3.9	5.0	7.0	9.0	11	14
914Ne-3	1400	3622	Total	0.9	1.9	2.9	5.0	7.8	8.0	11
			Inhibited	0.9	1.9	2.9	4.9	7.9	8.0	12
914Ne-4	1600	3621	Total	0.8	3.5	5.2	7.2	9.0	13	17
			Inhibited	0.5	2.9	4.0	5.7	8.0	12	18
914Ne-5	1800	3620	Total	0	10	17	20	23	24	24
			Inhibited	2.0	6.0	12	16	17	20	19
914Ne-6	2000	3618	Total	1.3	6.7	8.5	10	20	20	20
			Inhibited	1.1	5.0	7.8	8.0	10	9.0	11

I-10-Re

DIFFUSE SOURCE LOADING EVALUATION

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/14/77 Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ft-7	1600	3611	Total	0.6	1.9	3.0	3.9	4.6	5.5	6.3
			Inhibited	0.1	1.2	2.5	3.8	4.6	5.4	5.4
914Ft-8	1700	3606	Total	1.3	2.5	3.4	4.3	5.3	6.5	7.4
			Inhibited	1.4	2.6	3.3	4.4	5.2	6.0	7.4
914Ft-9	1800	3613	Total	1.5	3.1	4.3	5.7	7.6	8.6	9.0
			Inhibited	0.6	1.5	2.5	4.4	6.3	8.7	10
914Ft-10	1900	3612	Total	1.1	2.7	4.2	5.9	8.2	10	14
			Inhibited	1.1	2.4	3.0	4.0	5.8	6.6	8.4
914Ft-11	2000	3616	Total	0.7	2.4	4.2	6.2	7.7	9.0	14
			Inhibited	0.3	1.8	4.4	5.5	6.3	8.0	10

DIFFUSE SOURCE LOADING EVALUATION

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 9/14/77 Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
914Ft-1	1000	3623	Total	0.5	2.1	4.2	13	15	16	16
			Inhibited	0.6	1.7	2.4	3.2	4.4	5.7	10
914Ft-2	1100	3615	Total	0.8	2.1	4.2	7.0	7.0	8.0	12
			Inhibited	0.8	2.0	4.2	6.9	6.0	8.0	12
914Ft-3	1200	3622	Total	0.9	1.9	2.9	5.0	7.8	8.0	11
			Inhibited	0.9	1.9	2.9	4.9	7.9	8.0	12
914Ft-4	1300	3608	Total	0	7.0	13	18	19	23	28
			Inhibited	1.0	6.0	11	15	16	17	18
914Ft-5	1400	3607	Total	0.8	1.4	2.0	2.6	3.6	5.0	6.9
			Inhibited	0.6	1.0	1.4	2.5	2.8	3.4	4.4
914Ft-6	1500	3614	Total	0.8	1.6	2.5	3.2	3.9	4.7	5.7
			Inhibited	0.7	1.2	1.4	2.2	3.2	4.5	5.2

POINT SOURCE LOADING EVALUATION

Sample Composition-Collection Data

Source: Union Newark

Sample #	Date	Time of Collection	pH	Temp.C°	D.O. mg/1	Flow Rate (MGD)
913-U-N-1	9/13	2000	N.S.[1]	N.S.	N.S.	6.6
913-U-N-2	9/13	2359	"	"	"	6.9
914-U-N-3	9/14	0400	"	"	"	2.6
914-U-N-4	9/14	0800	6.8	24	1.5	2.6
914-U-N-5	9/14	1200	6.8	26	0.3	6.3
914-U-N-6	9/14	1500	7.0	26	0.6	5.9

[1] N.S. = Not Submitted.

Source: Union Irvington

Sample #	Date	Time of Collection	pH	Temp.C°	D.O. mg/1	Flow Rate (MGD)
913-U-Ir-1	9/13	1530	7.3	23	0.4	5.0
913-U-Ir-2	9/13	1930	N.S.	N.S.	N.S.	N.S.
913-U-Ir-3	9/13	2330	"	"	"	"
914-U-Ir-4	9/14	0330	"	"	"	"
914-U-Ir-5	9/14	0800	7.6	23	0.7	3.0
914-U-Ir-6	9/14	1200	7.2	23	1.2	5.0

Source: Sunnyvale †

Sample #	Date	Time of Collection	pH	Temp.C°	D.O. mg/1	Flow Rate (MGD)
91314-Su	9/13-14	1600-1300	7.13	20.0	2.4	13.43

† Sample Composited At Treatment Facility.

POINT SOURCE LOADING EVALUATION

Sample Composition-Collection Data

Source: Palo Alto

Sample #	Date	Time of Collection	pH	Temp.C°	D.O. mg/1	Flow Rate (MGD)
913-PA-1	9/13	1600	6.4	27.0	8.4	28
913-PA-2	9/13	2000	7.0	25.0	7.1	N.S.
913-PA-3	9/13	2359	7.1	25.5	8.0	25
914-PA-4	9/14	0400	7.0	26.0	8.5	15
914-PA-5	9/14	0800	N.S.	25.0	4.4	15
914-PA-6	9/14	1200	7.0	25.5	3.3	30

Source: San Jose

Sample #	Date	Time of Collection	pH	Temp.C°	D.O. mg/1	Flow Rate (MGD)
913SJ-1	9/13	1600	N.S.	N.S.	N.S.	28.0
913SJ-2	9/13	2000	N.S.	N.S.	N.S.	26.0
913SJ-3	9/13	2359	N.S.	N.S.	N.S.	24.5
914SJ-4	9/14	0400	N.S.	N.S.	N.S.	15.0
914SJ-5	9/14	0800	N.S.	N.S.	N.S.	15.0
914SJ06	9/14	1200	N.S.	N.S.	N.S.	25.5

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Source: Union Irvington

Type of Sample: Individual

Sample # (Descriptor)	Time or Collection	Total * Filtrable Residue mg/l	Non-* Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l
913-U-Ir-1 (3642)	1530	N.D.[1]	N.D.	11.9	0.003
913-U-Ir-2 (3644)	1930	"	"	7.1	<0.002
913-U-Ir-3 (3646)	2330	"	"	6.9	0.002
913-U-Ir-4 (3636)	0330	"	"	6.5	<0.002
913-U-Ir-5 (3638)	0800	2,580	110	7.1	<0.002
913-U-Ir-6 (3640)	1200	N.D.	N.D.	7.1	<0.002

N.D.[1] = No Data

* Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Date of Collection: 9/14/77

Type of Sample: Composite

Sample #	Source	Total * Filtrable Residue mg/l	Non-* Filtrable Residue mg/l	Nitrite * mg/l	Total * Ortho PO_4 mg/l	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
91314-U-N	Union Newark	2,460	7.1	0.007	10.3	3.6	9.7	0.16	120
91314-SJ	San Jose	1,260	68	1.74	1.1	3.5	3.4	0.33	170
91314-Se	Sunnyvale	N.D.[2]	N.D.	0.008	4.7	N.D.	N.D.	N.D.	N.D.

N.D.[2] = No Datum

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E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Date of Collection: 9/13-14/77
Source: Palo Alto
Type of Sample: Individual

Sample # (Descriptor)	Date (Time) of Collection	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	Nitrite* mg/l	Total* Filtrable Residue-mg/l	Non-* Filtrable Residue-mg/l	Total* Ortho PO_4-mg/l	TOC* mg/l
913PA-1 (3654)	9/13 (1600)	N.D.	N.D.	N.D.	<0.002	2,140	7.2	1.3	N.D.
913PA-2 (3655) (3656)	9/13 (2000)	4.9	2.4	1.1	<0.002	3,560	6.8	1.4	50
913PA-3 (3658)	9/13 (2359)	3.6	2.1	0.72	N.D	N.D.	N.D.	N.D.	62
914PA-4 (3647) (3648)	9/14 (0400)	3.4	2.0	0.44	<0.002	3,220	20	6.3	41
914PA-5 (3649) (3650)	9/14 (0800)	3.2	1.8	0.47	<0.002	3,800	9.6	0.99	59
914PA-6 (3651) (3656)	9/14 (1200)	3.0	1.8	1.9	<0.002	3,560	6.8	1.4	53

E.H. Smith & Associates
2/1/78-Revision

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 9/13-14/77

Source: Union-Irvington

Type of Sample: Individual

Sample # (Descriptor)	Time of Collection	Monitoring Interval (Days)	3	6	9	12	15	18	21
913U-Ir-1 (3642)	1530	Total	50	120	190	220	240	250	260
		Inhibited	10	60	140	170	210	230	250
913U-Ir-2 (3644)	1930	Total	70	150	220	270	290	200	200
		Inhibited	50	160	220	270	280	310	350
913J-Ir-3 (3646)	2330	Total	60	130	190	250	280	300	310
		Inhibited	70	130	170	220	290	300	300
914U-Ir-4 (3636)	0330	Total	60	100	160	190	230	240	240
		Inhibited	50	70	90	130	160	200	220
914U-Ir-5 (3638)	0800	Total	60	130	160	210	220	220	230
		Inhibited	50	130	170	200	190	200	200

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND *

Individual Samples

Date of Collection: 9/13-14/77

Source: Union-Irvington - (cont'd)

Sample # (Descriptor)	Time of Collection	Monitoring Interval (Days)	3	6	9	12	15	18	21
914U-Ir-6 (3640)	1200	Total	50	150	210	210	230	240	250
		Inhibited	50	150	160	160	180	180	190
Source: Palo Alto									
913-PA-1 (3654)	1600	Total	50	150	300	470	600	610	630
		Inhibited	20	230	280	440	560	590	600
913-PA-2 (3656)	2000	Total	60	160	330	410	430	460	470
		Inhibited	10	70	250	350	380	430	450
913-PA-3 (3653)	2359	Total	80	140	270	390	490	500	530
		Inhibited	110	130	250	370	410	460	480
914-PA-4 (3648)	0400	Total	90	130	230	290	310	330	350
		Inhibited	80	120	240	270	290	340	350

E.H. Smith & Associates
2/1/78-Revision

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND *

Individual Samples

Date of Collection: 9/13-14/77

Source: Palo Alto (cont'd)

Sample # (Descriptor)	Time of Collection	Monitoring Interval (Days)	3	6	9	12	15	18	21
914-PA-5 (3650)	0800	Total	50	130	290	320	310	310	320
		Inhibited	30	90	220	260	270	270	270
914-PA-6 (3652)	1200	Total	20	150	350	460	480	490	490
		Inhibited	30	90	150	180	280	390	410

E. H. Smith & Associates
Biological Consultants

4090 Harrison Grade Rd
Sebastopol, Ca 95472
(707) 874-3108

December 9, 1977

Dr. C.M. Harper
Environmental Services Dept.
Bechtel Incorporated
P.O. Box 3965
San Francisco, Ca. 94119

Dear Carol:

The field samples for the third South Bay sampling effort were collected during the period of 10/12 - 14/ 77. Sampling methods and labelling schemes are as described for the previous reports. Samples furnished by San Jose and Palo Alto treatment facilities could not be processed as no flow data were supplied with the samples.

The chemical assays for the fourth sampling effort are still being processed by the water quality laboratory, and the data will be forewarded to you after transcription of the data is complete.

Sincerely,

Bill Rotz

William G. Rotz

enc:

E.H. Smith & Associates
2/1/78-Revision

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection 9/13-14/77

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Source	Sample Type								
91314U-H	Union	Composite of 6	Total	60	130	200	240	250	260	270
			Inhibited	30	70	100	130	160	190	210
91314S-J	San Jose	Composite of 6	Total	50	90	160	210	230	220	230
			Inhibited	20	80	80	100	140	150	150
91314S-J	Sunnyvale	Composite of 6	Total	50	130	230	290	280	280	270
			Inhibited	20	90	130	180	200	220	220

*Assay performed by Pacific Marin Station Water Quality Laboratory

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 10/14/77

Time of Collection	Sample #	D.O. mg/l	Depth [1] ft.	Temp. C°	Salinity ppt	pH
0900	1014Mo-1	4.0	1.0	17.0	19.0†	7.6
1100	1014Mo-2	3.7	1.5	18.0	19.5†	7.6
1300	1014Mo-3	2.8	4.0	19.5	27.0	7.6
1500	1014Mo-4	3.8	4.5	20.0	30.5	7.4
1700	1014Mo-5	3.2	5.0	20.0	30.5	7.3
1900	1014Mo-6	3.4	2.0	19.0	25.0	7.5

Newark Slough

Time of Collection	Sample #	D.O. mg/l	Depth [1] ft.	Temp. C°	Salinity ppt	pH
0900	1014Ne-1	3.9	.5	17.0	32.1	8.2
1100	1014Ne-2	3.2 2.4 1.9	.5 2.5 4.6	21.0 20.0 20.0	30.2	8.3
1300	1014Ne-3	2.6 2.1	.5 2.0	19.5 19.8	28.0	8.3
1500	1014Ne-4	3.9 3.3	2.0 4.5	2.05 20.5	28.9	7.5
1700	1014Ne-5	6.1 4.6	.5 2.5	20.5 20.5	31.0	8.3
1900	1014Ne-6	5.2	.5	19.0	30.2	8.3

† Verified by Titration

[1] Depth of D.O. measurement

E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 10/14/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1014Mo-1	0900	3975	0.25	0.07	0.46	1.0
1014Mo-2	1100	3965	0.56	0.37	0.44	11
1014Mo-3	1300	3974	0.46	0.81	0.79	10
1014Mo-4	1500	3968	L.A.	2.7	0.43	78
1014Mo-5	1700	3971	0.68	L.A.	0.41	21
1014Mo-6	1900	3973	0.43	3.7	0.37	56

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1014Ne-1	0900	3952	0.77	3.1	0.48	42
1014Ne-2	1100	3945	5.1	1.4	0.97	14
1014Ne-3	1300	3957	0.90	L.A.	0.49	25
1014Ne-4	1500	3964	0.60	0.47	0.48	11
1014Ne-5	1700	3956	0.39	2.2	0.44	27
1014Ne-6	1900	3959	0.42	3.0	0.41	57

* Assay performed by Pacific Marine Station Water Quality Laboratory

L.A.= Laboratory Accident

E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1014Mo-1	0900	3961	433	21,600	1.0	0.031	0.6
2014Mo-2	1100	3970	216	30,220	0.52	0.048	1.7
1014Mo-3	1300	3967	360	31,400	1.2	0.038	14
1014Mo-4	1500	3972	194	32,500	0.90	0.047	0.2
1014Mo-5	1700	3966	270	30,300	1.1	0.042	0.2
1014Mo-6	1900	3969	292	27,300	0.86	0.056	1.0
Newark Slough							
1014Ne-1	0900	3958	314	36,300	2.5	0.099	4.8
1014Ne-2	1100	3950	362	31,200	2.0	0.093	0.7
1014Ne-3	1300	3963	85	31,700	1.9	0.17	3.7
1014Ne-4	1500	3960	83	34,800	1.5	0.12	2.1
1014Ne-5	1700	3962	83	34,400	2.1	0.11	3.0
1014Ne-6	1900	3955	466	32,400	2.3	0.089	56

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 10/14/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Sulfides mg/l
1014Mo-1	0900	3999	0.12
1014Mo-2	1100	3998	0.27
1014Mo-3	1300	3997	0.22
1014Mo-4	1500	3996	0.10
1014Mo-5	1700	3995	0.47
1014Mo-6	1900	3994	0.25
Newark Slough			
1014Ne-1	0900	3988	0.39
1014Ne-2	1100	3989	0.37
1014Ne-3	1300	3990	<0.10
1014Ne-4	1500	3991	0.17
1014Ne-5	1700	3992	0.29
1014Ne-6	1900	3993	0.47

*Assay performed by Pacific Marine Station Water Quality Laboratory

DIFFUSE SOURCE LOAD EVALUATION

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 10/14/77

Newark Slough

I-5-Re

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1014Ne-1	0900	3958	Total	5.7	8.1	17	20	20	21	24
			Inhibited	4.9	7.3	14	16	16	17	18
1014Ne-2	1100	3950		7.8	8.5	17	17	22	27	38
				6.1	7.2	10	12	16	17	20
1014Ne-3	1300	3963		6.8	9.0	12	15	15	18	21
				5.1	6.9	7.4	8.0	9.0	11	15
1014Ne-4	1500	3960		3.0	11	23	24	24	28	31
				1.7	8.4	14	16	18	19	20
1014Ne-5	1700	3962		8.8	9.6	15	20	21	26	28
				7.0	9.0	11	14	15	15	17
1014Ne-6	1900	3955		8.6	14	17	55	59	69	71
				6.4	10	14	20	30	48	52

DIFFUSE SOURCE LOADING EVALUATION

E.H. Smith & Associates
2/1/78-Revision

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 10/14/77

Mowry Slough

I-6-Re

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1014Mo-1	0900	3961	Total	1.4	4.8	6.4	7.2	8.2	8.9	9.2
			Inhibited	1.0	2.3	4.6	7.0	9.5	11	14
1014Mo-2	1100	3970		1.0	3.2	4.7	6.2	7.0	7.5	7.9
				0.8	2.1	3.9	4.4	5.6	6.7	6.9
1014Mo-3	1300	3967		2.7	5.1	6.8	L.A	L.A	L.A	L.A
				1.0	2.0	2.6	3.9	4.8	5.9	7.0
1014Mo-4	1500	3972		2.5	4.2	5.9	6.9	7.9	11	22
				2.0	3.6	5.0	5.5	6.1	8.1	9.0
1014Mo-5	1700	3966		3.0	5.1	6.8	8.3	8.0	12	14
				1.1	3.1	4.2	5.3	6.1	7.8	10
1014Mo-6	1900	3969		2.4	4.6	6.1	7.9	7.9	12	15
				2.1	2.7	3.8	6.7	7.1	11	13

SLOUGHS-HYDROLOGICAL DATA

Mowry Slough

Date of Collection: 10/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	1.5	25	50	40	1.25	25	31	Outgoing
1100	3.5	35	50	50	1.0	87	87	Incoming
1300	7.5	56	50	60	.83	267	223	Incoming
1500	9.0	>70	50	120	.42	354	149	Incoming
1700	6.0	52	50	41	1.2	195	237	Outgoing
1900	3.5	35	50	65	.77	87	67	Outgoing

Newark Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	1.5	21	30	34	.88	20	18	Incoming
1100	5.5	110	30	22	1.36	279	380	Incoming
1300	8.0	>120	30	38	.79	578	457	Incoming
1500	9.0	120	30	36	.83	687	573	Outgoing
1700	6.0	115	30	17	1.76	336	591	Outgoing
1900	3.5	62	30	42	.71	106	75	Outgoing

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DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 10/14/77

Time of Collection	Sample #	D.O. mg/1	Depth [1] ft.	Temp. C°	Salinity ppt	pH
0830	1014Ft-1	5.3	1.0	15.0	30.0	7.3
0915	1014Ft-2	4.8	1.0	15.0	31.1	7.4
1000	1014Ft-3	5.3	1.5	15.7	28.8	7.4
1100	1014Ft-4	5.7	2.0	19.0	29.0	7.6
1200	1014Ft-5	6.8	4.5	20.0	30.4	7.8
1300	1014Ft-6	7.0	3.5	20.9	30.5	7.5
1400	1014Ft-7	8.0	5.0	21.0	30.8	7.8
1500	1014Ft-8	7.5	5.0	21.0	30.1	7.7
1600	1014Ft-9	8.7	4.0	21.3	31.2	7.8
1700	1014Ft-10	8.8	3.0	21.3	30.2	7.6
1800	1014Ft-11	8.0	1.5	21.0	30.5	7.7
1900	1014Ft-12	6.7	1.0	19.5	29.0	7.6

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[1] Depth of D.O. measurement

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E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 10/14/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
1014Ft-1	0830	3949	8.4	0.50	0.43	7.9
1014Ft-2	0915	3954	1.2	2.3	0.44	40
1014Ft-3	1000	3953	1.8	2.9	0.35	30
1014Ft-4	1100	3951	1.6	1.2	0.38	9.6
1014Ft-5	1200	3947	5.4	0.43	0.75	7.2
1014Ft-6	1300	3948	0.95	0.33	0.35	4.9
1014Ft-7	1400	L.A	L.A	L.A	L.A	L.A
1014Ft-8	1500	3983	0.30	0.59	0.65	6.7
1014Ft-9	1600	3978	0.40	0.38	0.67	4.2
1014Ft-10	1700	3979	0.48	0.84	0.66	11
1014Ft-11	1800	L.A	L.A	L.A	L.A	L.A
1014Ft-12	1900	3977	0.60	<0.05	0.56	4.2

*Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection:

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total* Filtrable Residue mg/l	Total* Ortho PO_4 mg/l	Nitrite* mg/l	Chloro-* phyll-a mg/m^3
1014Ft-1	0830	3940	242	33,400	0.94	0.068	0.8
1014Ft-2	0915	3942	162	33,600	1.1	0.081	8.0
1014Ft-3	1000	3943	134	32,000	1.2	0.060	3.0
1014Ft-4	1100	3944	89	35,000	1.0	0.081	0.6
1014Ft-5	1200	3946	67	31,700	1.1	0.050	0.9
1014Ft-6	1300	3941	99	34,600	1.1	0.044	0.8
1014Ft-7							
1014Ft-8	1500	3986	96	34,800	0.95	0.048	4.8
1014Ft-9	1600	3987	111	34,300	0.95	0.053	0.74
1014Ft-10	1700	3984	164	32,000	0.92	0.064	0.8
1014Ft-11	1800	3982	152	33,600	1.1	0.066	0.2
014Ft-12	1900	3985	152	33,800	1.0	0.063	0.4

*Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 10/14/77

Sample #	Time of Collection	Laboratory Descriptor	Total* Sulfide mg/l
1014Ft-1	0830	4019	0.28
1014Ft-2	0915	4030	0.14
1014Ft-3	1000	4020	0.10
1014Ft-4	1100	4029	0.25
1014Ft-5	1200	4021	0.19
1014Ft-6	1300	4028	0.26
1014Ft-7	1400	4022	0.36
1014Ft-8	1500	4027	0.48
1014Ft-9	1600	4023	0.34
1014Ft-10	1700	4026	0.45
1014Ft-11	1800	4024	0.24
1014Ft-12	1900	4025	0.36

*Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND

Date of Collection: 10/14/77

Faber Tract Slough

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1014FT-1	0830	3940	Total	2.8	5.3	7.6	9.0	9.0	17	19
			Inhibited	2.1	3.4	5.5	6.5	8.0	8.3	12
1014FT-2	0915	3942		3.1	5.2	7.4	10	17	16	18
				1.0	4.1	4.6	7.1	9.5	7.9	10
1014FT-3	1000	3943		2.1	4.0	7.1	8.2	8.2	.9	12
				1.0	2.1	3.6	3.9	4.3	4.9	6.0
1014FT-4	1100	3944		1.4	4.5	7.2	8.9	8.9	8.9	9.0
				1.1	4.2	7.2	8.5	8.7	8.9	9.0
1014FT-5	1200	3946		1.9	3.7	5.2	6.1	7.2	8.4	8.5
				1.8	3.5	5.0	6.1	6.9	8.0	8.2
1014FT-6	1300	3941		3.6	5.6	6.2	6.8	7.1	7.8	8.2
				3.4	4.4	5.1	6.0	6.3	6.4	6.7

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E.H. Smith & Associates
2/1/78-Revision

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 10/14/77 **Faber Tract Slough**

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Time of Collection	Laboratory Descriptor								
1014FT-7	1400		Total	L.A.	L.A.	L.A.	L.A.	L.A.	L.A.	L.A.
			Inhibited	L.A.	L.A.	L.A.	L.A.	L.A.	L.A.	L.A.
1014FT-8	1500	3986		1.6	2.9	3.4	4.0	4.5	5.5	5.9
				1.3	2.8	3.5	4.0	4.2	4.9	5.6
1014FT-9	1600	3987		1.3	2.3	4.2	5.3	6.1	7.2	9.0
				0.6	0.9	1.2	2.4	2.8	2.9	3.0
1014FT-10	1700	3984		4.6	6.9	9.0	12	12	17	21
				3.0	4.0	5.2	6.8	7.1	8.1	8.6
1014FT-11	1800	3982		4.0	6.0	8.0	9.2	9.2	13	16
				3.6	4.1	5.1	6.0	8.3	9.1	9.5
1014FT-12	1900	3985		2.0	2.6	5.0	7.0	8.5	9.0	9.2
				1.7	1.9	2.5	3.6	5.1	6.4	6.4

L.A.=Laboratory Accident

E.H. Smith & Associates

SLOUGHS-HYDROLOGICAL DATA

Faber Tract Slough

Date of Collection: 10/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0830	1.8	10	10	120	0.08	12.6	<5	Outgoing
0915	2.0	12	10	62	0.16	16.0	<5	Incoming
1000	3.0	21	10	15	0.66	33.0	22	Incoming
1100	5.0	60	10	8	1.25	128.5	161	Incoming
1200	7.5	65	10	6.5	1.50	223.5	344	Incoming
1300	9.5	72	10	7	1.40	437	624	Incoming
1400	10.0	78	20	22	0.91	473	430	Incoming
1500	9.5	72	10	7	1.40	437	624	Outgoing
1600	8.5	70	20	8	2.50	336	840	Outgoing
1700	5.5	63	20	11	1.80	105	187	Outgoing
1800	3.5	31	10	12	0.80	50	42	Outgoing
1900	3.0	21	10	15	0.50	33	16.5	Outgoing

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RECEIVING WATER MONITORING

Date of Collection: 10/13/77

Sample #	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft.	Tide	Depth of Sample Ft.
1013RW-31-I	1000	8.0	6.0	21.0	13.0	30	Incoming	15
1013RW-137-I	1011	7.9	6.4	20.0	31.5	5	Incoming	2.5
1013RW-20-I	1015	7.9	6.2	20.0	31.5	10	Incoming	5
1013RW-8-I	1026	7.8	6.0	20.0	30.5	20	Incoming	10
1013RW-4-I	1040	7.3	1.5	20.0	24.0	10	Incoming	5
1013RW-31-II	1250	7.7	7.7	22.0	31.5	25	Incoming	12
1013RW-137-II	1305	7.9	7.0	20.5	31.5	10	Outgoing	5
1013RW-20-II	1322	7.1	7.3	20.5	30.0	25	Incoming	12
1013RW-8-II	1345	7.1	6.5	21.0	31.0	20	Incoming	10
1013RW-4-II	1400	7.5	5.8	21.0	28.0	10	Outgoing	5
1013RW-31-III	1535	7.8	7.2	21.0	30.0	35	Outgoing	18
1013RW-137-III	1548	7.6	7.6	20.5	31.0	9	Outgoing	5
1013RW-20-III	1355	7.9	7.4	21.0	31.0	20	Outgoing	10
1013RW-8-III	1405	7.9	6.9	21.0	31.0	10	Incoming	5

RECEIVING WATER MONITORING (cont'd)

Date of Collection: 10/13/77

Sample #	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft.	Tide	Depth of Sample Ft.
1013RW-4III	1420	7.5	3.4	22.0	25.0	10	Outgoing	5
1013RW-133	1312	7.0	7.0	20.5	30.0	15	Incoming	8
1013RW-128	1330	7.4	6.8	20.5	29.5	10	Incoming	5
1013RW-123	1355	7.5	6.0	21.0	29.5	15	Outgoing	7.5
1013RW-1	1410	7.6	4.2	21.0	30.0	15	Outgoing	7.5
1013RW-120	1425	7.7	6.0	20.5	29.0	17	Outgoing	8
1013RW-126	1250	7.5	2.3	19.0	27.2	5	Incoming	2
1013RW-130	1340	7.6	3.4	19.5	27.5	5	Incoming	2
1013RW-118	1500	7.3	2.3	19.2	19.0	5	Outgoing	2
1013RW-104	1445	7.7	3.8	25.5	1.8	5	Outgoing	2

E.H. Smith & Associates
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RECEIVING WATER MONITORING

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Total* Filtrable Residue mg/l	Non-* Filtrable Residue mg/l	Nitrite* mg/l	Total* Ortho PO_4 mg/l	Chloro-* phyll-a mg/m^3
1013RW-31-I	1000	3843	34,000	103	0.029	0.62	0.3
1013RW-137-I	1010	3885	31,700	122	0.047	0.74	0.6
1013RW-20-I	1015	3842	33,700	67	0.057	0.97	0.3
1013RW-8-I	1026	3887	34,300	111	0.11	1.2	1.1
1013RW-4-I	1040	3844	33,000	49	0.56	2.9	0.6
1013RW-31-II	1250	3873	35,900	43	0.020	0.62	0.7
1013RW-137-II	1305	3884	35,500	70	0.024	0.70	0.3
1013RW-20-II	1322	3877	L.A.	L.A.	L.A.	L.A.	L.A.
1013RW-8-II	1345	3888	35,300	68	0.041	0.82	0.6
1013RW-4-II	1400	3876	33,400	87	0.14	1.3	0.6
1013RW-31-III	1535	3883	35,700	78	0.019	0.63	0.6
1013RW-137-III	1548	3849	35,900	55	0.032	0.81	1.0
1013RW-20-III	1355	3847	36,500	64	0.031	0.86	0.6

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RECEIVING WATER MONITORING (cont'd)

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Total* Filtrable Residue mg/l	Non-* Filtrable Residue mg/l	Nitrite* mg/l	Total* Ortho PO_4 mg/l	Chloro-* phyll-a mg/m^3
1013RW-8-III	1435	3846	33,500	48	0.064	0.96	0.6
1013RW-4-III	14[illegible]	3845	[illegible]7,400	[illegible]19	0.29	2.3	1.2
1013RW-137	1312	3872	34,600	92	0.038	1.0	0.2
1013RW-128	1330	3881	31,100	88	0.078	0.80	0.8
1013RW-123	1355	3886	31,700	[illegible]	0.090	1.3	0.7
1013RW-1	1410	3871	31,900	83	0.20	0.73	0.1
1013RW-120	1425	3889	34,500	95	0.11	1.0	0.9
1013RW-126	1250	3880	31,000	315	0.19	1.9	10.01
1013RW-130	3140	3874	35,300	401	0.088	1.2	0.6
1013RW-118	1500	3879	L.A	L.A	0.73	1.9	L.A
1013RW-104	1445	3875	1600	17	1.6	3.7	0.4

*Assay performed by Pacific Marine Station Water Quality Laboratory

L.A.= Laboratory Accident

RECEIVING WATER MONITORING

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
1013RW-31-I	1000	3863	0.16	0.69	0.54	22
1013RW-137-I	1011	3861	3.5	0.54	0.61	14
1013RW-20-I	1015	3852	0.25	0.36	0.67	18
1013RW-8-I	1026	3858	4.0	0.80	0.92	16
1013RW-4-I	1040	3878	2.8	0.57	1.7	9.3
1013RW-31-II	1250	3860	0.19	1.7	0.35	20
1013RW-137-II	1305	3851	3.0	0.50	0.41	13
1013RW-20-II	1322	3869	1.3	0.66	0.48	14
1013RW-8-II	1345	3856	3.2	1.2	0.57	21
1013RW-4-II	1400	3848	0.45	2.0	1.1	98
1013RW-31-III	1535	3854	0.15	0.36	0.37	18
1013RW-137-III	1305	3855	0.18	0.46	0.51	10
1013RW-20-III	1355	3859	3.4	1.2	0.51	29
1013RW-8-III	1405	3862	3.5	0.81	0.83	12
1013RW-4-III	1420	3865	1.8	1.3	1.6	14
1013RW-133	1312	3870	3.9	1.2	0.56	23
1013RW-128	1330	3868	0.26	1.4	0.73	26
1013RW-123	1355	3866	0.44	3.2	0.95	71
1013RW-1	1410	3867	0.79	0.42	1.6	4.1
1013RW-120	1425	3882	SAMPLE LOST			
1013RW-126	1250	3850	1.1	0.59	1.2	18

RECEIVING WATER MONITORING (cont'd)

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
1013RW-130	1340	3857	0.49	1.9	0.99	37
1013RW-118	1500	3864	1.3	4.8	1.7	200
1013RW-104	1445	3853	12	32	3.1	490

*Assay performed by Pacific Marine Station Water Quality Laboratory

E.H. Smith & Associates
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RECEIVING WATER MONITORING

– 21 DAY BIOCHEMICAL OXYGEN DEMAND

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1013RW-31-I	1000	3843	Total	<0.05	1.3	1.7	2.2	4.9	3.9	5.2
			Inhibited	<0.05	0.4	0.9	1.1	1.4	2.0	3.1
1013RW-137-I	1010	3885		<0.05	1.6	2.2	3.1	4.0	4.8	5.1
				<0.05	0.1	0.6	1.4	1.9	2.1	3.0
1013RW-20-I	1015	3842		0.5	1.9	2.4	2.9	4.3	5.0	5.3
				0.1	0.4	0.9	1.5	2.4	2.8	2.8
1013RW-8-I	1026	3887		<0.05	2.2	3.1	4.6	5.5	6.5	7.6
				<0.05	0.8	1.3	1.7	2.0	2.8	2.9
1013RW-4-I	1040	3844		2.8	7.1	7.1	8.0	11	17	20
				1.7	5.0	6.1	6.7	8.0	11	13
1013RW-31-II	1250	3873		0.9	1.0	1.3	1.9	2.1	2.9	3.2
				0.8	1.1	1.3	1.7	2.2	2.8	3.1

E.H. Smith & Associates
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RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1013RW-137-II	1305	3884	Total	0.5	0.8	1.3	1.9	2.2	2.7	2.9
			Inhibited	<0.05	0.4	0.9	1.1	1.8	2.0	2.6
1013RW-20-II	1322	3887		No Data - L.A.						
1013RW-8-II	1345	3888		0.4	1.1	1.4	2.1	2.7	3.2	3.4
				<0.05	0.3	0.8	1.3	2.0	2.4	2.9
1013RW-4-II	1400	3876		1.2	3.8	5.1	7.1	8.0	10	12
				0.6	0.9	2.1	2.9	4.0	4.6	5.1
1013RW-31-III	1535	3883		3.8	7.0	12	16	23	26	31
				2.1	4.0	6.8	8.9	11	14	19
1013RW-137-III	1548	3849		<0.05	1.2	1.7	2.2	2.8	3.6	4.0
				<0.05	0.2	0.4	0.9	1.3	1.5	1.6

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RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND (cont'd)

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1013RW-20-III	1355	3847	Total	0.1	1.1	1.6	2.3	2.8	3.4	4.6
			Inhibited	<0.05	0.6	0.8	1.4	1.6	2.1	2.9
13RW-8-III	1405	3846		0.9	1.6	2.7	2.9	4.2	5.3	5.6
				0.3	0.7	1.3	1.7	2.2	2.6	3.0
1013RW-4-III	1420	3845		<0.05	0.4	0.5	0.9	0.9	0.9	1.3
				<0.05	0.1	0.3	0.5	0.6	0.5	0.5
1013RW-133	1312	3872		0.1	0.9	1.6	2.2	3.3	4.1	4.5
				<0.05	0.2	1.0	1.2	2.1	2.6	2.9
1013RW-128	1330	3881		1.6	1.8	2.3	3.0	4.1	4.5	4.9
				<0.05	0.4	0.8	1.2	1.9	2.2	2.5
1013RW-123	1355	3886		0.1	0.5	0.5	0.5	0.7	1.0	1.1
				0.1	0.4	0.5	0.5	0.5	0.6	0.6

RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1013RW-1	1410	3871	Total	<0.05	2.8	4.5	4.9	5.2	6.0	9.0
			Inhibited	<0.05	1.0	1.3	2.9	3.6	4.2	5.0
1013RW-120	1425	3889		0.1	2.5	3.4	4.5	6.7	7.7	7.8
				0.1	1.1	1.4	1.5	2.0	3.4	4.1
1013RW-126	1250	3880		3.0	6.0	7.0	11	15	19	22
				1.1	2.1	4.0	5.6	6.6	9.1	11
1013RW-130	1340	3874		2.0	3.1	5.6	6.4	6.4	13	15
				1.4	1.8	2.2	4.0	5.2	7.0	10
1013RW-118	1500	3879		4.0	7.2	7.7	15	16	18	19
				3.9	5.2	8.0	11	13	14	16
1013RW-104	1445	3875		4.6	14	20	23	37	63	65
				3.0	4.5	8.9	10	15	20	24

*Assay performed by Pacific Marine Station Water Quality Laboratory

POINT SOURCE LOADING EVALUATION

Sample Composition-Collection Data

Source: Union Newark

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/l	Flow Rate (MGD)
1012UN-1	10/12	1530	7.5	27	0.1	5.80
1012UN-2	10/12	1930	N.D	N.D	N.D	6.65
1012UN-3	10/12	2330	N.D	N.D	N.D	7.00
1013UN-4	10/13	0330	N.D	N.D	N.D	3.10
1013UN-5	10/13	0730	7.4	25	0.0	1.80
1013UN-6	10/13	1200	6.8	25	0.0	7.0
		Source: Union Irvington				
1012UI-1	10/12	1530	7.2	25	0.04	6.5
1012UN-2	10/12	1930	7.2	N.D	N.D	6.5
1012UI-3	10/12	2230	7.1	N.D	N.D	6.0
1013UI-4	10/13	0130	7.5	N.D	N.D	5.0
1013UI-5	10/13	0730	7.4	23	0.02	3.0
1013UI-6	10/13	1100	7.3	24	0.04	7.5
		Source: Sunnyvale+				
101213SU	10/12-13	1600-1200	7.23	19	1.2	16.33

+ Sample composited at treatment facility.

N.D.=No data

POINT SOURCE LOADING EVALUATION

Date of Collection: 10/12-10/13/77

Type of Sample: Composite

Sample #	Source	Total* Filtrable Residue mg/l	Non-* Filtrable Residue mg/l	Nitrite* mg/l	Total* Ortho PO_4 mg/l	Ammonia* Nitrogen mg/l	Organic* Nitrogen mg/l	Nitrate* mg/l	TOC* mg/l
101213-UN	Union Newark	2100	72	<0.005	7.4	38	5.6	0.23	270
101213-UI	Union Irvington	1620	28	<0.005	5.2	5.5	20	0.14	350
101213-Su	Sunnyvale	1050	112	<0.005	5.9	2.1	2.9	0.26	70

*Assay performed by Pacific Marin Station Water Quality Laboratory

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 10/12-10/13/77

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Source	Sample Type								
101213-UN	Newark	Composite of 6	Total	6.3	13	21	55	80	250	540
			Inhibited	4.0	8.0	12	30	44	70	100
101213-UN	Irvington	Composite of 6		6.9	8.0	24	43	65	75	80
				3.2	4.1	9.0	21	31	40	46
101213-SU	Sunnyvale	Composite of 6		1.8	45	65	76	160	170	180
				0.4	10	30	43	90	110	140

* Assay performed by Pacific Marin Station Water Quality Laboratory

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E. H. Smith & Associates
Biological Consultants

4090 Harrison Grade Rd
Sebastopol, Ca 95472
(707) 874-3108

January 20, 1978

Dr. C.M. Harper
Environmental Services Dept.
Becthel Incorporated
P.O. Box 3965
San Francisco, Ca. 94119

Dear Carol:

The field collections for the fourth and final quarter for South Bay Dischargers were collected during the period of 11/15 - 11/ 17, 1977. The labeling system for the various sources are as explained in previous reports.

Due to inaccessibility, two receiving water stations (grids 41 and 100) could not be sampled. As for point source samples, all were received in good order along with information required for sample composition.

Also enclosed is the benthal demand data with a brief explanation of methods and materials and data presentation.

A final report is pending. The report will include methods and materials for the benthal demand analysis, and for the water quality monitoring of South San Francisco Bay.

Sincerely,

Bill

William G. Rotz

BENTHAL DEMAND

Introduction

Samples for the benthal demand were collected on 12/28/77. Three stations were sampled in duplicate for each of three specified incubation temperatures. The core samples were collected from the following areas: Faber Tract Marsh, at the diffuse source loading evaluation station; Alviso Slough within sampling grid number 118; and the Palo Alto Harbor area. Following installation into the apparatus, the cores were equilibrated to the specified temperatures, then monitored for decreases in D.O. concentration for a period of 28 hours.

Sample data are labeled according to location (Faber Tract:FT; Palo Alto: PA· Alviso:AL), temperature of incubation (10,18, and 25 °C), and replicate (A or B).

Uptake Rates

Dissolved oxygen concentrations were determined using the iodometric method (Standard Methods, 13th ed.) modified at our facility for small volumes. The rate of uptake was calculated from observed changes in oxygen concentrations over time. These data are presented in two forms: cumulative rates and rates between O_2 determinations (rates within a given time interval).

Cumulative Rates

O_2 uptake rates were calculated for each sampling time interval. The time interval consists of the time from $t_i - t_0$, where t_0 = time fo the first O_2 determination, and t_i = the time of the ith O_2 determination. The maximum time interval was 28 hours, and the uptake rates for the 28 hour interval are refered to as the "total" rate. These O_2 rates have been termed cumulative rates.

Rates Between O_2 Determinations

The O_2 rates for only the time interval between O_2 determinations were also calculated. In this case, $\Delta t = t_a - t_b$, where t_a = the time at the end of the interval, and t_b = the time at the beginning of the interval. For example, for the time interval from 4 to 22 hours, Δt=18 hours.

Since replicate cores were collected at each station, certain basic sample statistics have been performed.

The data have been summarized as described to facilitate single data point entry into the math model.

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E.H. Smith & Assocaites

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 11/16/77

Time of Collection	Sample #	D.O. mg/1	Depth ft.	Temp. C°	Salinity ppt	pH
0800	1116Mo-1	4.0	2.5	13.5	29.34 †	7.6
1000	1116Mo-2	4.0	1.5	13.5	20.0	7.6
1200	1116Mo-3	4.0	1.0	15.0	17.50 †	7.6
1400	1116Mo-4	4.2	2.0	15.0	26.0	7.6
1600	1116Mo-5	4.8	3.0	15.0	30.6	7.6
1700	1116Mo-6	4.8	3.0	14.5	30.5	7.7

Newark Slough

Time of Collection	Sample #	D.O. mg/1	Depth ft.	Temp. C°	Salinity ppt	pH
0800	1116Ne-1	1.2	1.0	13.0	29.0	7.6
1000	1116Ne-2	1.2	1.0	13.0	31.0	7.5
1200	1116Ne-3	2.5	.5	14.8	32.0	7.6
1400	1116Ne-4	1.9	1.5	15.0	30.0	7.6
1600	1116Ne-5	1.4	1.5	15.5	29.52 †	7.3
1800	1116Ne-6	1.5	1.5	15.2	30.05 †	7.5

* Verified by Titration

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 11/16/77

Time of Collection	Sample #	D.O. mg/1	Depth ft.	Temp C°	Salinity ppt	pH
0800	1116Ft-1	4.8	1.5	12	31.5	7.6
0900	1116Ft-2	4.2	1.0	11	27.2	7.5
1000	1116Ft-3	3.8	1.0	11.1	30.4	7.5
1100	1116Ft-4	4.7	.5	12.5	30.0 *	7.5
1200	1116Ft-5	4.7	1.0	13.5	31.0	7.5
1300	1116Ft-6	6.3	1.0	15.5	31.0	7.5
1400	1116Ft-7	6.6	2.0	14.9	30.0	7.4
1500	1116Ft-8	6.6	2.5	14.8	31.0	7.9
1600	1116Ft-9	6.4	3.0	14.5	32.0	7.7
1700	1116Ft-10	6.8	2.5	14.5	31.0	7.5
1730	1116Ft-11	6.8	2.0	14.5	29.5	7.5

* Verified by Titration

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

[illegible] Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1116Mo-1	0800	4257	0.51	0.69	0.21	27
1116Mo-2	1000	4222	0.50	0.79	0.56	36
1116Mo-3	1200	4221	0.68	0.37	0.23	31
1116Mo-4	1400	4219	0.60	2.0	0.40	30
1116Mo-5	1600	4220	0.61	0.76	0.19	22
1116Mo-6	1700	4256	0.61	0.35	0.19	56

[illegible] Slough

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1116Mm-1	0800	4258	1.7	0.61	0.16	69
1116Mm-2	1000	4251	1.2	0.56	0.65	46
1116Mm-3	1200	4250	1.3	0.60	0.76	47
1116Mm-4	1400	4252	2.0	1.2	0.54	72
1116Mm-5	1600	4255	2.2	0.73	0.88	100
1116Mm-6	1745	4249	2.3	1.5	1.1	59

* Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1116Ft-1	0800	4259	L.A.	L.A.	L.A.	L.A.
1116Ft-2	0900	4263	1.3	0.35	0.92	90
1116Ft-3	1000	4254	1.4	0.43	0.42	71
1116Ft-4	1100	4262	1.5	L.A.	0.19	73
1116Ft-5	1200	4218	1.4	0.43	0.81	36
1116Ft-6	1300	4261	L.A.	0.50	0.80	64
1116Ft-7	1400	4253	0.96	0.70	0.31	49
1116Ft-8	1500	4260	L.A.	L.A.	L.A.	L.A.
1116Ft-9	1600	4224	1.2	0.36	0.48	61
1116Ft-10	1700	4225	1.5	0.35	0.71	48
1116Ft-11	1730	4223	0.61	0.40	0.49	28

* Assay performed by Pacific Marine Station Water Quality Laboratory

L.A. = Laboratory Accident

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DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO$_4$ mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1116Mo-1	0800	4123	230	30,400	1.3	0.11	2.4
1116Mo-2	1000	4121	240	23,700	1.2	0.13	1.5
1116Mo-3	1200	4134	120	18,300	0.36	0.12	4.8
1116Mo-4	1400	4126	300	29,000	0. .3	0.14	5.0
1116Mo-5	1600	4122	260	31,900	1.2	0.14	1.3
1116Mo-6	1 30	4120	150	31,800	1.4	0.19	2.3

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO$_4$ mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1116Nw-1	0800	4130	80	31,100	2.0	0.29	5.5
1116Nw-2	1000	4125	140	32,800	1.9	0.21	6.6
1116Nw-3	1200	4125	340	32,400	2.0	0.23	11
1116Nw-4	1400	4128	190	30,500	2.0	0.32	5.7
1116Nw-5	1600	4125	1000	30,100	2.0	0.29	1.8
1116Nw-6	1745	4131	94	31,700	1.3	0.32	L.A.

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO$_4$ mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1116Ft-1	0800	4133	110	33,300	1.2	0.17	4.1
1116Ft-2	0900	4137	110	32,300	1.2	0.17	3.0
1116Ft-3	1000	4136	120	32,640	0.98	0.17	3.6
1116Ft-4	1100	4135	120	32,700	1.1	0.13	3.3
1116Ft-5	1200	4139	130	32,400	1.2	0.18	3.2
1116Ft-6	1300	4141	120	33,000	1.3	0.17	4.2
1116Ft-7	1400	4138	100	33,400	1.2	0.18	6.0
1116Ft-8	1500	4142	92	33,900	1.0	0.13	3.7
1116Ft-9	1600	4140	110	33,100	1.0	0.17	2.1
1116Ft-10	1700	4132	78	33,400	1.1	0.16	2.0
1116Ft-11	1730	4127	110	32,700	1.2	0.14	2.1

* Assay performed by Pacific Marine Station Water Quality Laboratory

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Dissolved Sulfides mg/l
1116Mo-1	0800	4343	0.26
1116Mo-2	1000	4344	0.18
1116Mo-3	1200	4353	0.07
1116Mo-4	1400	4347	0.46
1116Mo-5	1600	4350	0.46
1116Mo-6	1730	4345	0.14

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Total * Dissolved Sulfides mg/l
1116Nw-1	0800	4354	0.52
1116Nw-2	1000	4348	1.0
1116Nw-3	1200	4349	0.03
1116Nw-4	1400	4352	0.54
1116Nw-5	1600	4346	0.35
1116Nw-6	1745	4351	0.40

* Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Dissolved Sulfides mg/l
1116Ft-1	0800	4337	0.18
1116Ft-2	0900	4342	0.27
1116Ft-3	1000	4336	0.29
1116Ft-4	1100	4341	0.41
1116Ft-5	1200	4335	0.14
1116Ft-6	1300	4340	0.15
1116Ft-7	1400	4344	0.18
1116Ft-8	1500	4339	0.14
1116Ft-9	1600	4333	0.19
1116Ft-10	1700	4338	0.42
1116Ft-11	1730	4332	0.27

* Assay performed by Pacific Marine Station Water Quality Laboratory

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77 **Mowry Slough**

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1116Mo-1	0800	4123	Total	1.8	3.6	5.1	5.7	5.9	6.3	7.0
			Inhibited	1.5	3.2	5.3	6.2	6.3	6.8	7.0
1116Mo-2	1000	4121		1.7	3.4	5.2	5.7	5.9	6.0	6.2
				1.4	2.7	6.0	6.8	7.1	7.3	7.6
1116Mo-3	1200	4134		0.9	1.8	3.8	4.9	5.2	5.7	5.9
				1.1	1.8	3.6	4.2	5.0	6.3	6.2
1116Mo-4	1400	4126		2.8	4.4	6.3	6.6	6.8	7.2	7.6
				2.2	2.9	4.9	5.4	5.9	7.5	7.6
1116Mo-5	1600	4122		2.1	3.9	5.6	5.8	6.5	6.6	7.3
				1.2	2.7	4.6	6.0	6.2	6.6	6.6
1116Mo-6	1730	4120		0.9	2.9	5.3	6.4	6.5	7.0	7.1
				0.4	2.1	4.8	6.0	6.4	7.2	7.1

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77 **Newark Slough**

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1116Ne-1	0800	4130	Total	4.5	8.2	15	15	18	25	25
			Inhibited	4.1	7.3	10	14	20	26	23
1116Ne-2	1000	4125		3.8	7.7	19	L.A.	19	28	28
				1.8	3.1	5.9	7.9	8.4	8.4	8.5
1116Ne-3	1200	4129		6.6	13	15	15	18	25	25
				5.8	13	19	16	19	28	28
1116Ne-4	1400	4128		5.1	14	15	15	15	28	28
				4.0	10	15	14	18	L.A.	L.A.
1116Ne-5	1600	4124		4.6	7.7	14	14	14	14	14
				3.1	5.1	7.8	6.0	9.0	8.0	11
1116Ne-6	1745	4131		5.7	8.4	16	17	23	29	29
				4.7	6.2	16	13	17	28	28

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77 **Faber Tract Slough**

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Time of Collection	Laboratory Descriptor								
1116Ft-1	0800	4133	Total	2.4	4.8	7.9	9.4	16	22	25
			Inhibited	2.6	3.2	5.8	8.0	9.4	9.6	10
1116Ft-2	0900	4137		2.4	5.4	9.0	12	15	16	17
				1.7	3.9	10	10	12	13	14
1116Ft-3	1000	4136		2.5	5.7	8.9	1.5	15	25	25
				2.5	5.5	8.9	9.0	9.0	9.0	9.0
1116Ft-4	1100	4135		10	10	15	20	20	22	22
				6.6	12	11	13	15	L.A.	L.A.
1116Ft-5	1200	4139		3.4	7.2	8.7	16	17	18	18
				2.7	6.8	8.7	12	10	30	30
1116Ft-6	1300	4141		2.2	5.1	7.9	9.1	9.2	9.0	9.2
				0.9	2.4	6.5	8.2	8.8	8.8	8.8

E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77 **Faber Tract Slough**

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Time of Collection	Laboratory Descriptor								
1116Ft-7	1400	4138	Total	1.0	3.1	6.1	7.0	7.1	7.8	8.3
			Inhibited	0.9	2.6	6.2	6.6	7.6	7.6	7.8
1116Ft-8	1500	4142		1.1	3.0	5.0	5.8	6.6	6.7	7.1
				0.7	1.4	3.5	4.2	6.0	7.3	7.3
1116Ft-9	1600	4140		3.1	4.3	6.5	7.4	8.2	7.9	8.2
				2.9	3.9	5.5	6.0	7.7	8.1	8.3
1116Ft-10	1700	4132		1.5	2.7	5.3	6.6	7.5	8.1	9.2
				1.1	1.5	3.2	4.3	5.5	7.3	7.5
1116Ft-11	1730	4127		5.1	6.9	9.3	12	13	15	16
				3.9	3.0	5.4	11	7.8	10	9.6

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E.H. Smith & Associates

SLOUGH HYDROLOGY

Mowry

Date of Collection: 11/16/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	5.5	51	50	60	.83	178	154	Outgoing
1000	3.5	35	50	73	.69	87	60	Outgoing
1200	2.5	34	50	93	.54	55	30	Incoming
1400	5.5	51	50	60	.83	186	154	Incoming
1600	8.0	63	50	129	.39	303	118	Incoming
1730	7.5	59	50	105	.48	267	128	Outgoing

Newark

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	4.5	104	25	135	.18	231	42	Outgoing
1000	3.5	62	25	38	.66	106	70	Outgoing
1200	3.0	60	25	30	.83	89	74	Incoming
1400	5.5	112	25	25	1.0	280	280	Incoming
1600	7.5	>120	25	125	.2	537	107	Incoming
1800	7.0	>120	25	60	.42	499	208	Outgoing

E.H. Smith & Associates

SLOUGH HYDROLOGY

Faber Tract

Date of Collection: 11/16/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	5.5	62	20	37	.54	140	75	Outgoing
0900	5.0	60	10	22	.45	110	50	Outgoing
1000	3.0	20	10	29	.34	33	11	Outgoing
1100	2.5	16	10	120	.10	24	<5	Slack
1200	4.0	41	20	30	.66	70	47	Incoming
1300	5.0	60	20	25	.80	110	88	Incoming
1400	6.5	65	20	25	.80	194	155	Incoming
1500	7.5	65	20	15	1.33	260	346	Incoming
1600	8.5	70	20	37	.54	328	177	Incoming
1700	8.0	70	20	18	1.1	293	322	Outgoing
1730	6.5	65	20	15	1.33	194	258	Outgoing

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft.
1117-RW-31-I	0920	7.6	7.0 7.0 7.0	15.0 15.0 15.0	31.2	40	Outgoing	1.0 Mid-Depth 40
1117-RW-137-I	0930	7.5	7.0 7.0 7.0	15.0 14.5 14.5	31.9	10	Outgoing	1.0 Mid-Depth 40
1117-RW-20-I	0950	7.6	7.0 7.0 7.0	15.0 14.5 14.5	31.2	20	Outgoing	1.0 Mid-Depth 20
1117-RW-8-I	1020	7.6	6.0 5.8 5.8	14.0 14.0 14.0	31.10†	18	Outgoing	1.0 Mid-Depth 18
1117-RW-4-I	NOT SAMPLED							
1117-RW-31-II	1350	7.6	7.0 6.8 6.8	15.0 15.0 15.0	29.8	30	Incoming	1.0 Mid-Depth 30
1117-RW-137-II	1405	7.6	7.2 7.0 6.9	15.0 15.0 14.9	31.2	5.0	Incoming	1.0 Mid-Depth 5.0
1117-RW-20-II	1410	7.7	7.0 7.0 6.8	15.0 15.0 15.0	31.5	20	Incoming	1.0 Mid-Depth 20

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	pH	D.O. mg/l	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft
1117-RW-8-II	1420	7.5	6.2 6.2 6.2	15.0 15.0 15.0	28.0	15	Incoming	1.0 Mid-Depth 15
1117-RW-4-II	1430	7.3	2.8 2.8 2.8	15.0 15.0 15.0	22.52 †	15	Incoming	1.0 Mid-Depth 15
1117-RW-128	1000	7.4	6.4 6.3 6.2	14.0 14.0 14.0	31.0	4.0	Outgoing	1.0 Mid-Depth 4.0
1117-RW-123	1025	7.3	5.4 5.4 5.4	14.0 14.0 14.0	28.0	4.0	Outgoing	1.0 Mid-Depth 4
1117-RW-1	1435	7.3	3.2 3.0 2.6	17.5 17.5 17.5	12.06 †	10	Incoming	1.0 Mid-Depth 10
1117-RW-120	1100	7.2	3.2 3.2 3.2	14.5 14.5 14.5	24.0	12	Outgoing	1.0 Mid-Depth 12
1117-RW-31-II	1515	7.4	6.6 6.6 6.4	15.0 15.0 14.0	30.0	35	Incoming	1.0 Mid-Depth 35

† Verified by Titration

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	pH	D.O. mg/1	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft
1117-RW-137-III	1520	7.8	7.4 7.4 7.2	15.0 15.0 15.0	30.1	10	Incoming	1.0 Mid-Depth 15
1117-RW-20-III	1525	7.7	6.6 6.6 6.5	15.0 15.0 15.0	30.2	20	Incoming	1.0 Mid-Depth 20
1117-RW-8-III	1540	7.7	6.6 6.4 6.4	15.0 15.0 15.0	29.5	20	Incoming	1.0 Mid-Depth 20
1117-RW-4-III	1550	7.4	4.0 3.9 3.8	15.0 15.0 14.9	23.2	10	Incoming	1.0 Mid-Depth 10

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	pH	D.O. mg/1	Temp. C°	Salinity ppt	Depth ft	Tide	Depth of Sample ft
1117-RW-100	NOT SAMPLED							
1117-RW-118	0950	7.3	3.8	14.5	18.0	<5	Outgoing	Mid-Depth
1127-RW-104	0930	7.4	5.25	23.9	2.5	<5	Outgoing	Mid-Depth
1117-RW-126	0800	7.5	4.7	12.5	28.0	<5	Outgoing	Mid-Depth
1117-RW-130	0730	7.4	0.55	15.5	25.0	<5	Outgoing	Mid-Depth
1117-RW-133	0940	7.6	5.6 5.6 5.6	14.0 14.0 14.0	28.0	10	Outgoing	1.0 Mid-Depth 10

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Filtrable Residue mg/1	Non-* Filtrable Residue mg/1	Total * Ortho PO_4 mg/1	Nitrite * mg/1	Chloro-* phyll-a mg/m^3
1117-RW-31-I	0920	4163	35,100	110	0.75	0.072	2.6
1117-RW-137-I	0930	4155	33,100	75	1.0	0.14	2.9
1117-RW-20-I	0950	4144	34,200	59	1.1	0.14	3.4
1117-RW-8-I	1020	4158	32,800	110	1.3	0.13	4.5
1117-RW-31-II	1350	4162	34,100	55	0.78	0.071	3.7
1117-RW-137-II	1405	4156	34,000	63	1.0	0.12	3.2
1117-RW-20-II	1410	4154	33,800	65	0.97	0.13	2.8
1117-RW-8-II	1420	4165	32,300	76	1.2	0.21	3.6
1117-RW-4-II	1430	4152	21,100	140	3.0	0.54	5.1
1117-RW-128	1000	4145	32,800	58	1.1	0.17	3.6
1117-RW-123	1025	4153	32,560	110	1.3	0.23	2.7
1117-RW-1	1435	4157	14,100	85	4.1	0.47	7.9
1117-RW-120	1100	4172					

* Assay performed by Pacific Marine Station Water Quality Laboratory

E.H. Smith & Associates

RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	Laboratory Descriptor	Total * Filtrable Residue mg/1	Non- * Filtrable Residue mg/1	Total * Ortho PO_4 mg/1	Nitrite * mg/1	Chloro- * phyll-a mg/m^3
1117-RW-31-III	1515	4160	34,000	110	0.71	0.065	2.8
1117-RW-137-III	1520	4161	33,800	55	0.82	0.084	2.9
1117-RW-20-III	1525	4151	34,500	64	0.92	0.10	3.1
1117-RW-8-III	1540	4149	33,820	58	1.1	0.06	3.3
1117-RW-4-III	1550	4148	28,400	150	2.0	0.43	6.1
1117-RW-118	0950	4150	21,300	87	2.8	0.70	4.8
1117-RW-104	0930	4146	1,580	23	1.2	0.96	1.8
1117-RW-126	0800	4147	32,700	180	1.1	0.15	3.6
1117-RW-130	0730	4159	31,400	110	1.6	0.33	4.4
1117-RW-133	0940	4164	32,300	460	1.0	0.12	16

* Assay performed by Pacific Marine Station Water Quality Laboratory

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RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1117-RW-31-I	0520	4177	0.35	0.31	0.31	19
1117-RW-137-I	0930	4176	0.68	0.45	0.55	33
1117-RW-20-I	0950	4171	0.61	0.48	0.47	10
1117-RW-8-I	1020	4175	0.85	1.3	0.56	46
1117-RW-31-II	1350	4186	0.43	0.26	0.19	18
1117-RW-137-II	1405	4178	0.66	0.39	0.24	23
1117-RW-20-II	1410	4181	0.57	0.41	0.20	31
1117-RW-8-II	1420	4185	0.76	0.43	0.28	43
1117-RW-4-II	1430	4188	4.4	0.68	0.45	95
1117-RW-128	1000	4217	0.69	0.43	0.21	24
1117-RW-123	1025	4216	0.97	0.43	0.33	62
1117-RW-1	1435	4187	9.2	1.7	0.35	90
1117-RW-120	1100	4174	3.2	0.91	0.78	52

* Assay performed by Pacific Marine Station Water Quality Laboratory

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RECEIVING WATER MONITORING

Date of Collection: 11/17/77

Sample #	Time of Collection	Laboratory Descriptor	Ammonia * Nitrogen mg/l	Organic * Nitrogen mg/l	Nitrate * mg/l	TOC * mg/l
1117-RW-31-III	1515	4180	0.50	0.25	0.65	23
1117-RW-137-III	1520	4183	0.42	0.42	0.30	26
1117-RW-20-III	1525	4179	0.54	0.41	0.20	27
1117-RW-8-III	1540	4173	0.66	0.37	0.50	18
1117-RW-4-III	1550	4184	2.2	0.71	0.33	61
1117-RW-118	0950	4150	L.A.	L.A.	L.A.	L.A.
1117-RW-104	0930	4167	11	0.21	1.2	30
1117-RW-126	0800	4170	0.65	1.1	0.56	21
1117-RW-130	0730	4169	2.6	0.92	0.51	17
1117-RW-133	0940	4182	0.50	0.37	0.16	24

* Assay performed by Pacific Marine Station Water Quality Laboratory

L.A. = Laboratory Accident

RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1117RW-31-I	0920	4163	Total	1.0	1.7	3.1	3.0	3.8	5.1	5.3
				0.9	1.6	3.1	3.0	3.0	4.0	4.0
1117RW-137-I	0930	4155		1.0	2.0	4.2	5.3	5.7	6.3	6.9
				1.1	2.1	4.1	5.2	6.3	6.9	7.0
1117RW-20-I	0950	4144		0.7	2.6	4.3	5.2	5-4	5.4	5.5
				0.8	1.2	3.6	4.5	5.5	6.3	6.5
1117RW-6-I	1020	4158		0.4	2.8	4.9	4.9	5.4	5.7	5.8
				0.1	1.2	3.2	3.5	5.3	5.8	6.0
1117RW-31-II	1350	4162		0.7	1.5	3.2	3.2	3.6	4.6	4.9
				0.6	1.5	2.8	2.1	2.6	2.8	3.0

* Assay performed by Pacific Marine Station Water Quality Laboratory

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RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1117RW-137-II	1405	4156	Total	0.7	2.2	4.4	4.8	5.5	5.7	6.1
			Inhibited	0.7	1.6	3.6	4.7	5.6	6.2	6.4
1117RW-20-II	1410	4154		0.4	1.3	3.6	4.6	5.1	5.9	6.0
				0.2	1.1	2.5	3.0	4.0	4.2	4.4
1117RW-8-II	1420	4165		1.5	3.2	5.5	5.8	5.9	6.5	6.8
				1.4	3.3	5.6	6.2	6.2	6.3	7.0
1117RW-4-II	1430	4152		6.9	8.0	10	12	21	37	38
				4.5	6.0	15	13	19	23	23
1117RW-128	1000	4145		1.0	2.3	3.3	3.5	3.9	4.0	4.2
				0.7	1.6	2.8	2.9	3.4	3.4	3.4

* Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1117RW-20-III	1525	4151	Total	0.3	1.4	3.1	4.1	4.3	5.2	5.5
			Inhibited	0.1	0.9	4.1	3.8	4.8	5.1	5.4
1117RW-8-III	1540	4149		1.2	3.0	4.8	5.3	5.9	6.3	6.5
				0.8	1.7	3.8	4.9	5.5	4.8	5.1
1117RW-4-III	1550	4148		7.2	8.0	16	18	22	32	31
				6.0	13	16	14	24	24	24
1117RW-118	0950	4150		2.5	6.0	19	16	21	21	24
				0.1	4.4	7.4	12	L.A.	L.A.	L.A.
1117RW-104	0930	4146		6.4	16	27	30	37	57	56
				6.7	21	22	21	27	32	31

E.H. Smith & Associates

RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1117RW-123	1025	4153	Total	1.5	3.6	5.8	7.1	7.5	7.5	7.5
			Inhibited	0.7	1.5	4.2	5.0	6.8	7.3	7.4
1117RW-1	1435	4157		5.0	9.0	8.0	19	48	61	61
				4.9	7.2	8.7	16	43	57	57
1117RW-120	1100	L.A.								
1117RW-39-III	1515	4160		0.9	1.3	3.0	3.2	4.0	4.7	4.8
				0.4	1.4	2.4	2.5	2.8	2.8	3.0
1117RW-137-III	1520	4161		0.7	2.1	3.7	4.2	4.6	5.1	5.3
				0.6	1.5	2.7	2.8	2.8	4.1	4.1

* Assay performed by Pacific Marine Station Water Quality Laboratory

L.A. = Laboratory Accident

E.H. Smith & Associates

RECEIVING WATER MONITORING

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Monitoring Interval (Days)	3	6	9	12	15	18	21
1117RW-126	0800	4147	Total	3.3	4.9	6.5	7.2	7.8	8.0	8.3
			Inhibited	2.9	4.6	6.7	7.4	8.1	8.3	8.3
1117-RW-130	0730	4159		5.0	9.0	9.0	12	16	14	15
				3.9	13	14	10	17	15	15
1117RW-131	0940	4164		3.3	4.5	5.4	6.2	6.2	6.5	6.8
				3.6	4.8	5.8	6.1	6.2	6.7	6.8

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Sample Composition-Collection Data

Source: Union Irvington

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/l	Flow Rate (MGD)
1115-U-Ir-1	11/15	1530	7.3	21	.5	5.5
1115-U-Ir-2	11/15	2000	N.S.	N.S.	N.S.	6.5
1115-U-Ir-3	11/15	2359	N.S.	N.S.	N.S.	5.5
1116-U-Ir-4	11/16	0400	N.S.	N.S.	N.S.	5.0
1116-U-Ir-5	11/16	0800	7.4	20	.5	4.5
1116-U-Ir-6	11/16	1200	7.4	20	0.0	8.8

Source: Union Newark

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/l	Flow Rate (MGD)
1115-U-Ne-1	11/15	1500	7.4	24	0.0	5.6
1115-U-Ne-2	11/15	1930	N.S.	N.S.	N.S.	6.0
1115-U-Ne-3	11/15	2330	N.S.	N.S.	N.S.	6.2
1115-U-Ne-4	11/16	0330	N.S.	N.S.	N.S.	2.4
1116-U-Ne-5	11/16	0735	7.2	22	0.0	1.5
1116-U-Ne-6	11/16	1200	7.1	23	0.0	6.8

Source: Sunnyvale

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/l	Flow Rate (MGD)
1115116-Su	11/15-16	1600 - 1200	7.4	15	3.4	16.2

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Sample Composition-Collection Data

Source: Palo Alto

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/1	Flow Rate (MGD)
1115-PA-1	11/15	1600	7.0	24	6.4	25
1115-PA-2	11/15	2000	7.1	23	6.4	25
1115-PA-3	11/15	2359	7.1	23	7.5	18
1116-PA-4	11/16	0400	7.1	23	8.0	11
1116-PA-5	11/16	0800	7.1	23	7.0	16
1116-PA-6	11/16	1200	7.2	23	6.5	30

Source: San Jose

Sample #	Date	Time of Collection	pH	Temp. C°	D.O. mg/1	Flow Rate (MGD)
1115-SJ-1	11/15	1600	7.1	25	7.1	110
1115-SJ-2	11/15	2000	7.5	26	5.8	110
1115-SJ-3	11/15	2359	7.5	26	7.5	108
1116-SJ-4	11/16	0400	7.5	25	6.6	55
1116-SJ-5	11/16	0800	7.4	25	6.4	35
1116-SJ-6	11/16	1200	7.5	25	6.0	110

E.H. Smith & Associates

POINT SOURCE LOADING EVALUATION

Date of Collection: 11/15-16/77

Type of Sample: Composite

Sample # (Descriptor)	Source	Ammonia* Nitrogen mg/1	Organic* Nitrogen mg/1	Nitrate* mg/1	Nitrite* mg/1	Total* Filtrable Residue-mg/1	Non-* Filtrable Residue-mg/1	Total* Ortho PO_4-mg/1	TOC* mg/1
111516-U-Ne	Union Newark	40	11	0.46	0.005	910	99	9.5	490
111516-U-Ir	Union Irvington	0.69	9.9	0.99	0.005	850	63	12	410
111516-SJ	San Jose	16	5.9	0.20	0.74	760	77	7.0	250
111516-SU	Sunnyvale	37	9.7	0.31	0.005	3340	44	10	230
111516-PA	Palo Alto	0.66	3.1	0.41	0.44	700	90	6.8	300

* Assay performed by Pacific Marine Station Water Quality Laboratory

POINT SOURCE LOADING EVALUATION

21 DAY BIOCHEMICAL OXYGEN DEMAND*

Date of Collection: 11/16/77

			Monitoring Interval (Days)	3	6	9	12	15	18	21
Sample #	Source	Sample Type	Total	60	81	120	110	130	180	200
111516-Su	Sunnyvale	Composite of 6	Inhibited	54	60	110	110	120	130	130
111516-SJ	San Jose			60	84	160	150	170	190	200
				60	42	72	63	99	60	60
111516-Ne	Newark			110	130	170	170	200	240	250
				110	87	110	110	100	110	100
111516-Ir	Irvington			130	150	180	170	190	240	250
				120	130	120	105	140	130	120
111516-PA	Palo Alto			39	54	80	80	80	140	180
				42	42	39	43	47	54	54

* Assay performed by Pacific Marine Station Water Quality Laboratory

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BENTHAL [illegible]

Rates of O_2 Uptake

I. Cumulative Rates

ml $O_2/m^2/h$

Sample #	Temp. C°: Δt: Date: Time Interval:	10 4h 12/29 1115-1515	22h 12/29-30 1115-0915	28h/Total 12/29-30 1115-1515
FT-10 A		1.57	5.13	6.89
FT-10 B		1.88	7.06	7.03
PA-10 A		0.0	4.22	5.19
PA-10 B		0.0	2.73	5.24
A1-10A		3.76	4.84	5.24
A1-10B		3.44	2.45	5.28

Sample #	Temp. C°: Δt: Date: Time Interval:	18 4h 12/29 1115-1515	22h 12/29-30 1115-0915	28h 12/29-30 1115-1515
FT-18A		N.S.[1]	3.69	4.44
FT-18B			3.76	5.12
PA-18A			6.33	6.37
PA-18B			6.61	7.15
A1-18A			6.54	4.96
A1-18B			3.90	4.37

[1]. NOT SAMPLED

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BENTHAL DEMAND

Rates of O_2 Uptake

I. Cummulative Rates

ml $O_2/m^2/h$

	Temp. C°:	25		
	Δt:	4h	22h	28h
	Date:	12/28	12/28-29	12/28-29
Sample #	Time Interval:	1115-1515	1115-0930	1115-1530
FT-25A		22.56	8.37	6.58
FT-25B		17.54	6.32	4.96
PA-25A		26.00	7.24	7.16
PA-25B		21.60	6.95	6.31
Al-25A		23.81	7.46	6.84
Al-25B		25.07	9.63	7.56

BENTHAL DEMAND

Rates of O_2 Uptake

II. Rates Between O_2 Determinations

	Temp. C°:	10		
	Δt:	4h	18h	6h
	Date:	12/29	12/29-30	12/30
Sample #	Time Interval:	1115-1515	1515-0930	0930-1530
FT-10A		1.57	5.91	13.36
FT-10B		1.88	8.21	6.89
PA-10A		0.0	5.15	8.77
PA-10B		0.0	3.34	9.81
Al-10A		3.76	5.08	6.68
Al-10B		3.44	2.23	15.66

	Temp. C°:		18	
	Δt:		18h	6h
	Date:		12/29-30	12/30
Sample #	Time Interval:		1515-0930	0930-1515
FT-18A		N.S.[1]	3.69	6.68
FT-18B			3.76	9.19
PA-18A			6.33	6.47
PA-18B			6.61	8.77
Al-18A			6.54	6.02
Al-18B			5.43	4.59

[1]. NOT SAMPLED

E.H. Smith & Associates

BENTHAL DEMAND

Rates of O_2 Uptake

II. Rates Between O_2 Determinations

ml $O_2/m^2/h$

Sample #	Temp. C°: Δt: Date: Time Interval:	25 4h 12/29 1115-1515	18h 12/79-30 1515-0915	6h 12/30 0945-1515
FT-25A		22.56	5.22	0.0
FT-25B		17.54	3.83	0.0
PA-25A		26.00	3.01	6.89
PA-25B		21.60	3.69	3.96
Al-25A		23.81	3.13	4.59
Al-25B		25.07	5.43	2.29

E.H. Smith & Associates

BENTHAL DEMAND

Mean Rates of O_2 Uptake
I. Cumulative Rates

ml $O_2/m^2/h$

Sample#	Temp. C° Δt: Date: Time Interval:	10 4h 12/29 1115-1515 $\bar{x}$	s^2	s	n	22h 12/29-30 1115-0915 $\bar{x}$	s^2	s	n	28h/Total 12/29-30 1115-1515 $\bar{x}$	s^2	s	n
FT10		1.72	.05	.219	2	6.09	1.86	1.36	2	6.96	0.01	0.10	2
PA 10		0.00	-	-	2	3.47	1.11	1.36	2	5.21	.001	.035	2
AL10		3.60	.05	.226	2	3.64	2.85	1.69	2	5.26	.001	.028	2
	Temp. C°	18											
FT18		Not Sampled				3.72	.002	0.05	2	4.78	0.23	0.48	2
PA18		"	"			6.47	0.04	.197	2	6.76	0.30	0.55	2
AL18		"	"			5.22	3.48	1.86	2	4.51	0.40	0.63	2
	Temp. C°	25											
FT25		20.1	12.6	3.5	2	7.34	2.10	1.45	2	5.77	1.30	1.14	2
PA25		23.8	9.70	3.11	2	7.09	0.04	0.21	2	6.73	0.36	0.60	2
AL25		24.4	0.79	0.89	2	8.54	2.30	1.50	2	7.20	0.26	0.51	2

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BENTHAL DEMAND

Mean Rates of O_2 Uptake
II. Rates Between Determinations
ml $O_2/m^2/h$

Temp. C°:	10											
Δt:	4h				18h				6h			
Date:	12/29				12/29-30				12/29-30			
Time Interval:	1115-1515				1115-0915				1115-1515			
Sample #	$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n
PT10	As for 10° Cumulative Rates				7.06	2.64	1.62	2	8.62	44.8	6.69	2
PA10					4.25	1.60	1.28	2	9.29	0.54	0.73	2
AL10					3.65	4.10	2.00	2	11.17	40.0	6.30	2
Temp. C°	18											
PT18	Not Sampled				3.72	.002	0.05	2	7.93	3.15	1.77	2
PA18					6.47	0.04	0.19	2	7.62	2.65	1.62	2
AL18					5.98	0.62	0.78	2	5.30	1.02	1.01	2
Temp. C°	25											
PT25	As for 25° Cumulative Rates				4.25	0.96	0.98	2	0.00	-	-	2
PA25					3.35	0.23	0.48	2	5.42	4.30	2.07	2
AL25					4.28	2.60	1.62	2	3.44	2.65	1.62	2

BENTHAL DEMAND

CHEMICAL PARAMETERS

Date of Collection: 12/28/77

Overlying Water

Sample #	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Temp. C°	Total* Sulfides mg/l	T.O.C.* mg/l	Total* Volatile Solids mg/g	p.H	Salinity ppt	D.O. mg/l
1228PT-W	4357	1.4	12	0.19	5.1	-	7.5	27.5	4.8
1228PA-W	4355	1.3	15	0.10	12	-	7.6	28.0	7.2
1228A1-W	4356	3.0	14.0	0.05	100	-	7.4	27.5	3.4

Sediments

Sample #	Laboratory Descriptor	Ammonia* Nitrogen mg//kg	Temp. C°	Total Volatile* Solids mg/g	p.H.
1228PT-S	4377	4.7	12	24	6.9
1228PA-S	4376	4.1	13	30	6.8
1228A1-S	4375	10	12	39	6.9

* Assay performed by Pacific Marine Station Water Quality Laboratory

E.H. Smith & Associates

BENTHAL DEMAND

Biochemical Oxygen Demand

Date of Collection: 12/28/77

Sample #	Laboratory Descriptor	Immediate	Sampling Interval (Days) 1	3	5	7
1228FT-S	4375	1.1	2.5	2.7	17	31
1228PA-S	4376	2.4	2.7	4.1	5.0	6.0
1228A1-S	4377	0.3	1.0	1.3	1.8	2.1

Sediment Analysis

Sample #	Total Wt.	Phi Units: Microns:	0.737 6.00	1.234 425	2.000 250	2.474 180	3.000 125	3.737 75	3.989 63	4.7818 38	4.718 38
1228FT-S	54.71		13.49	1.84	5.62	2.27	1.2	2.32	0.37	1.5	26.1
1228PA-S	50.61		0.2	0.1	0.06	0.17	0.24	0.67	0.6	0.42	48.9
1228AL-S	58.4		0.82	0.0	0.01	0.0	0.09	0.67	0.0	1.42	55.41
					Percent Weight						
1228FT-S	-		24.60	3.63	10.27	4.15	2.19	4.24	0.67	2.74	47.7
1228PA-S	-		0.39	0.19	0.12	0.34	0.47	1.34	1.19	0.83	96.11
1228A1-S	-		1.40	0	0.17	0	0.15	1.15	0	2.43	94.8

E.H. Smith & Associates

BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Faber Tract Marsh

Temperature	10°		18°		25°	
Core Number	FT10A	FT10B	FT18A	FT18B	FT25A	FT25B*
SPECIES						
Polychaeta						
Cirratulidae	2	4	-	-	1	
Neanthes succinea	2	1	-	-	2	
Polychaete "A"	21	27	35	45	52	
Polydora sp.	-	-	1	1	-	
Streblospio benedicti	3	5	10	13	5	
Arthropoda						
Corophium sp.	-	1	1	-	1	
Gnorimosphaeroma sp.	-	1	3	-	-	
Mollusca						
Nassarius obsoletus	1	-	-	-	-	

* Fauna not enumerated

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E.H. Smith & Associates

BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Palo Alto Harbor

Temperature	10°		18°		25°	
Core Number	PA10A	PA10B	PA18A	PA18B	PA25A	PA25B*
SPECIES						
Polychaeta						
Cirratulidae	2	14	9	1	18	
Neanthes succinea	1	-	5	-	1	
Polychaete "A"	14	62	96	18	32	
Polydora sp.	-	-	-	-	1	
Streblospio benedicti	31	19	31	12	26	
Arthropoda						
Corophium sp.	5	1	3	3	4	
Mollusca						
Nassarius obsoletus	-	-	-	1	-	

* Fauna not enumerated

E.H. Smith & Associates

BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Alviso Harbor

Temperature	10°		18°		25°	
Core Number	AL10A	AL10B	AL18A	AL18B	AL25A	AL25B *
SPECIES						
Polychaeta						
Eteone californica	-	-	2	1	-	
Neanthes succinea	-	-	1	-	-	
Polychaete "A"	68	58	88	43	40	
Polydora sp.	-	-	-	-	3	
Streblospio benedicti	-	1	35	9	14	
Arthropoda						
Corophium sp.	4	6	9	1	14	

* Fauna not enumerated

E. H. Smith & Associates
Biological Consultants

4090 Harrison Grade Rd
Sebastopol, Ca 95472
(707) 874-[illegible]

June 27, 1978

Dr. C. M. Harper
Bechtel Corporation
P. O. Box 3965
San Francisco, Ca. 94119

Dear Carol,

Please find enclosed a Preliminary report on the South Bay marsh study. We have attempted to point out areas of interest, and ones that might have some bearing on the model verification results.

When we have more time to go over the marsh literature in more detail we will look at other factors beside the D.O. A complete review of the data from a non-model view point should be made. We had hoped to complete this type of analysis, but did not have the time to complete it.

We trust the enclosed analysis will be some help to you in completing the report, and in relating the model reverification to field conditions. If you have any questions, please call.

Sincerely yours,

ES

Edmund H. Smith

EHS/eb

PRELIMINARY

REVIEW OF MODEL VERIFICATION DATA
FOR SOUTH BAY MARSH STUDIES

for

SOUTH BAY DISCHARGERS AUTHORITY
CLEAN WATER GRANT PROJECT
(FIELD STUDY FOR MATHEMATICAL MODEL REVERIFICATION)

Submitted to:
Environmental Services Section
Bechtel, Inc.

Prepared by:
E. H. Smith & Associates
4090 Harrison Grade Road
Sebastopol, California 95472

June 28, 1978

PRELIMINARY

SUMMARY

1) From August-November, 1977 four separate, yet interrelated, water quality sampling programs were performed. These programs were: Point Source Loading Evaluation, Receiving Water Monitoring, Diffuse Source Load Evaluation, and Benthal Demand Analysis. Data obtained from these programs were used to reverify the mathematical model of Hydroscience, Inc.

2) D.O., temperature, and salinity data from this study, an ongoing USGS study, and from a 1975-1976 survey by E. H. Smith and Associates indicated that vertical stratification of the water column did not occur. However, as indicated by Kelly and Tippets (1977), high unregulated Delta outflows will cause vertical stratification at Dumbarton Point.

3) Three sloughs were sampled to provide data for reverification of marsh loading by the mathematical model: Newark Slough, Mowry Slough, and Faber Tract Marsh. The pecularities of San Francisco Bay may prohibit the South Bay marshes from being characterized by "standard" marsh classification. The distinct wet and dry seasons normally occurring; and according to Hinde, (1954) the development of South Bay marshes on alluvial fans is peculiar to San Francisco Bay which complicates classification.

4) The areal marsh coverage was calculated from USGS maps updated by recent aerial photographs. From the sampling site, the

PRELIMINARY

upstream and downstream marsh area for each slough was: Mowry Slough, 0.89 and 0.47; Newark Slough, 0.13 and 0.77; Faber Tract March, 0.09 and 0.0 mi^2, respectively. In some cases, the calculated areas are larger than those used by Hydroscience, Inc.

5) At Mowry and Newark Sloughs, marsh flooding does not occur on every high tide each day. Some days the marsh floods on one high tide, and other days on both high tides. Futhermore, there are days in which marsh flooding does not occur at all. Parts of the Faber Tract Marsh area will flood daily. The duration and extent of marsh flooding for all three areas is dependent on the daily tidal cycle.

6) Examining the D.O. and salinity data obtained in each slough, it was observed that a different daily regime occurred in each slough. The salinity regime was attributed to the Bay salinity for Faber Tract Marsh; and probably a fresh water input upstream of the sampling site in Newark Slough, and downstream of the sampling site on Mowry Slough. D.O. was correlated to a variety of water quality parameters. The lack of recurrent significant correlations during the four sampling dates indicates that none of the selected water quality parameters, alone, is significantly associated with changes in D.O.

7) D.O. values in the water column of Newark Slough varied with depth. During October, 1977 the D.O. values were observed to proportionally decrease with increasing depth.

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8) Incoming tidal water at Newark and Mowry Sloughs may be affected by movement through 4 to 5 miles of marsh prior to the sampling site. Therefore, this water may not necessarily reflect Bay water conditions. Incoming water at Faber Tract Marsh comes directly from the Bay.

9) Benthal demand data showed substantial variation between cores and between areas at the same temperature. Measurements of oxygen uptake increased with higher temperatures.

10) The values for oxygen uptake from the benthal demand analysis as described, were found to be comparable to those measured by other authors under similar experimental conditions.

11) No detailed information was available for comparison of this benthal demand analysis to that performed by Hydroscience, Inc. in 1967. No indication was given by Hydroscience, Inc. as to how their single value of 0.1 gm/m^2/day was derived as being representative of South Bay. The variability in oxygen uptake measurements as a result of between core variance per temperature, and between areas (as observed by us) was not addressed in the recent Hydroscience, Inc. report.

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1.0 INTRODUCTION

Over the past several years, a variety of environmental studies have been performed for the South Bay Dischargers Authority Clean Water Grant Project. A part of these studies has included mathematical modeling of the water quality of South Bay by Hydroscience, Inc. All data has been reviewed by the Special Studies Unit of the State Water Resources Control Board (SWRCB) and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). As a result of a series of meetings between these two agencies, it was decided that further water quality field data be obtained for mathematical model reverification. The SWRCB and the SFBRWQCB felt that four separate, though interrelating, sampling programs should be performed to obtain the necessary data for model reverification. The field study programs selected were: Point Source Loading Evaluation, Receiving Water Monitoring, Diffuse Source Load Evaluation, and Benthal Demand Analysis. These four programs were performed during August-November, 1977. All data obtained from these field collections have been previously submitted to Bechtel, Inc. in four separate reports.

A description of the South Bay environment is presented herein to give the reader, when examining the water quality data and mathematical model reverification report, a biological overview of the study area. This report is concerned primarily with describing the marsh studies for the recent field programs, and the benthal demand analysis.

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In 1975-1976, E. H. Smith & Associates (1977) made a one year survey of the marine invertebrates of South Bay. It was found that there were several different faunal assemblages in South Bay. As part of the study, particle size analysis was performed. The overall conclusion from the particle size analysis was that South Bay consisted mainly of clay and silt, with over 90% of the sediment routinely passing through a 0.063 mm sieve.

Nichols (1977) investigated the infaunal biomass in relation to the productivity of a mudflat. This study was performed near the Palo Alto Yacht Harbor. According to Nichols, river input is very small in South Bay, and should be considered a secondary source of organic matter for mudflats. Of more importance are the resuspension and tidal transport of the surface sediment, which play an essential role in food supply and regeneration of dissolved nutrients. Nichols also mentioned that the breakdown of marsh plant material may take several months before the organic constituents are fully available to mudflat animals.

2.0 METHODS AND MATERIALS

The field sampling program for the mathematical model reverification was divided into four phases: Phase 1, Point Source Loading Evaluation; Phase 2, Receiving Water Monitoring; Phase 3, Diffuse Source Load Evaluation; Phase 4, Benthal Demand Analysis. Water samples for Phases 1-3 were collected within a two day period once each month from August-November 1977. The dates and time of sample collection accompany all data previously submitted. A complete description of the sampling design and water quality determinations was itemized in the state specifications for this project. A summary of the collecting methodology is presented.

2.1

Phase 1 - Point Source Loading Evaluation

Composite samples for chemical assay were collected at four hour intervals for 24 hours once each month by five dischargers: Palo Alto, Sunnyvale, San Jose, Newark-Irvington, Newark-Union. In addition to collecting the water samples, measurements of D.O., temperature, pH, and flow rate were made by the dischargers for each sampling interval. These water samples were then flow proportioned at the water quality laboratory prior to assay; except for the samples collected by Sunnyvale, which were flow proportioned on site during collection.

2.2

Phase 2 - Receiving Water Monitoring

Fifteen sampling stations were selected based upon the grid array

developed for the mathematical model of Hydroscience, Inc. (Fig. 1). Of these 15 stations, five were selected for sampling at four hour intervals during the daylight tidal cycle: grid numbers 31, 137, 20, 8, and 4. The remaining 10 stations were sampled once when accessible (i.e. water depth limitations). The selection of all stations, and the five stations for repeated sampling, were approved by Hydroscience, Inc. All receiving water samples were collected during a single day. Field measurements of D.O., temperature, salinity, and pH were made with portable field meters.

2.3

Phase 3 - Diffuse Source Evaluation

Three sloughs were selected for this phase. Selection criteria for the three sloughs were that two sloughs shall be significantly influenced by marshlands, and the third shall represent a slough without extensive marshland. The three sloughs were selected by representatives of E. H. Smith & Associates, the SWRCB, and the SFBRWQCB during a field survey. During this survey it was observed that virtually all sloughs in South Bay were surrounded by marshland, and that many sloughs were not accessible by land or boat. Therefore, the following areas for Phase 3 were selected according to accessibility: Mowry Slough (Grid #126), Newark Slough (Grid #130), and Faber Tract Marsh (no grid number). The specifications stated that during the 12 hour sampling interval each month, only one of the three sloughs was to be sampled at hourly intervals. The remaining two sloughs were to be sampled every two hours. The objective of this phase was to examine the effects of marshland loading. Of the three

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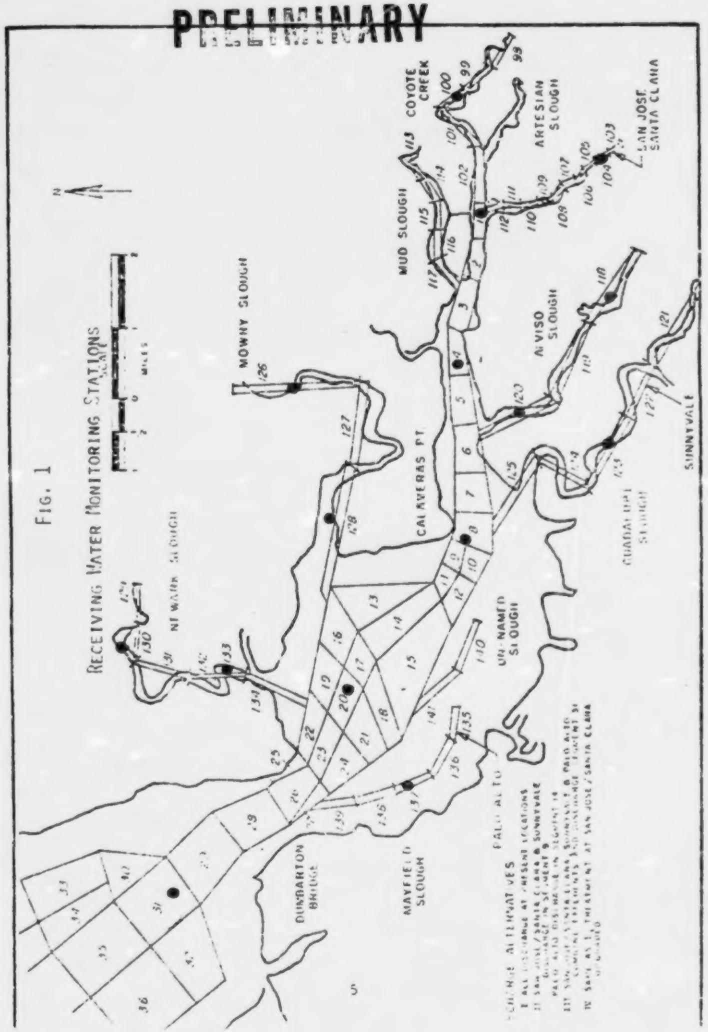
N
SCALE
MILES
NEWARK SLOUGH
MOWRY SLOUGH
MUD SLOUGH
COYOTE CREEK
ARTESIAN SLOUGH
SAN JOSE SANTA CLARA
ALVISO SLOUGH
CALAVERAS PT.
GUADALUPE SLOUGH
SUNNYVALE
UNNAMED SLOUGH
PALO ALTO
DUNBARTON BRIDGE
MAYFIELD SLOUGH

Fig. 1

Receiving Water Monitoring Stations

RESEGMENTATION OF SOUTH SAN FRANCISCO BAY MODEL (DETAIL)

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sloughs chosen, Faber Tract Marsh most closely represented an "extensive marsh", and was therefore selected as the site for hourly sample collection. The term "extensive marsh" refers to a large scale extensive marsh inland of the sampling site, and open bay water immediately seaward of the sampling site.

Measurements of D.O., temperature, salinity and pH were made by field meters. In addition to the water quality sampling, the flow rate of water in each slough was obtained in the following manner. Neutrally buoyant drifter bottles were used for the determination of water velocity. Depths of the sloughs were read directly from a stage rod installed in the deepest part of each slough. Cross sectional area was derived from the measured width of each slough and from bottom profiles determined with a recording fathometer. Flow rates of each slough were presented in ft^3/sec (cfs). A description of the sampling sites in each slough is given in Section 4.1.

The reliability of the drifters as water velocity indicators was tested prior to sampling using fluorometric techniques. Fluorescent dyes have been used for many years to accurately measure stream velocity. A slough of the Petaluma River was chosen for the test area. Several drifter bottles and one liter of 1.0g/l fluorescent dye (pontacyl pink) were simultaneously released into the slough at the same location. Ten yards downstream, discrete water samples were collected every 20 seconds to determine dye concentration, and the time required for the drifters to travel the

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same ten yards was noted. This procedure was repeated several times. It was found that a nearly identical time period was required for the drifters, and for the maximum dye concentration to travel 10 yards. It was concluded that the drifter bottles would serve as a reliable means of measuring slough water velocity.

2.4

All water samples for chemical assay were delivered to a certified laboratory, Pacific Marine Station-Water Quality Laboratory, within six hours after collection was completed. During collection and delivery, samples were maintained at approximately 4°C. in coolers. All samples were preserved immediately upon collection as specified by this laboratory.

Field measurements of D.O. were made using YSI D.O. meters. Salinity measurements were obtained with YSI S-C-T meters, and pH determined by a Corning pH meter. Prior to each sampling effort the D.O. meters and salinometer were calibrated at our facility against the Winkler and silver nitrate titrations, respectively. Unusual salinity values were verified by titration from collected samples shortly after return from the field.

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3.0 VERTICAL PROFILE - CENTRAL SOUTH BAY

Substantial vertical stratification of the water column in South Bay, as commonly determined by changes in salinity, did not occur during the August-November 1977 sampling period. In November, 1977 measurements of D.O., temperature, and salinity were obtained at three depths for nearly all receiving water stations. Examination of this data (previously submitted) indicated very minor changes of these parameters at each station.

Recent data, 1978, on these same three parameters, vertically profiled at 1 meter depths, was obtained from an ongoing USGS Water Quality Monitoring Program throughout San Francisco Bay. USGS began sampling in February at two week intervals at 11 stations in the Bay. The only station, No. 11, located in lower South Bay is at Dumbarton Point. A summary of this preliminary data for temperature, and salinity is presented in Fig. 2. In most cases, each of the water quality measurements varied slightly (1-2 units) along the depth profile. Temperature increased over time, with a mean value of 11.5°C. in early February, to 16.9°C. in late April, with no recurrent pattern in temperature change with respect to depth. Dissolved oxygen remained fairly constant, 8-9 ppm; the range of D.O. values varied slightly according to depth, 0.5-2 ppm. Although there were no consistant trends in D.O. change and depth, it was interesting to note that the D.O. values were generally greatest at mid-depth, and lowest at the water surface and near bottom. Salinity consistently increased with greater depth; with the salinity increases being minor, 1-2 ppt. From February to

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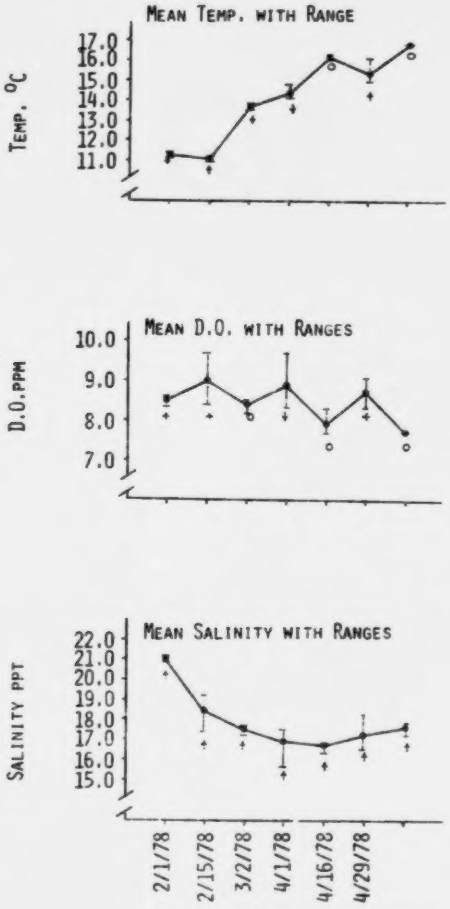
Key:
- ↑ Increase with depth
- ↓ Decrease with depth
- o No clear trend
- + Greatest at mid-depth

Note: D.O. generally greatest at middle depths - lower at end points

FIG. 2

USGS WATER QUALITY DATA PRELIMINARY

DUMBARTON POINT



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early April, the mean salinity steadily decreased from 21.2 to 17.2 ppt. The salinity then increased slightly to 17.9 ppt. in late April.

In the 1975-1976 survey by E. H. Smith & Associates (1977), 15 stations were sampled quarterly for a variety of water quality determinations. These determinations included D.O., salinity, and temperature. At six of the 15 stations, samples were collected at 3 m depth intervals. This data also showed that vertical stratification of D.O., salinity, and temperature did not occur.

It is apparent from our data, and that obtained from the USGS, that the water column in lower South Bay is not substantially affected by vertical stratification. However, as indicated by Kelly and Tippets (1977), high unregulated Delta outflows do stratify the water column in South Bay. After reviewing several years' data, the authors observed that high Delta outflows of 7.3 maf in January 1969, and 9.3 maf in February 1969 reduced surface salinities in South Bay from a normal 30 ppt down to 8-12 ppt. They concluded that Delta outflows near 7 maf/month are probably required to stratify salinity in the southern half of South Bay (presumably near the Dumbarton Bridge). The effect of these high Delta outflows on the salinity stratification in the water south of the Dumbarton Bridge was not discussed.

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4.0 Marsh Areas of South Bay

Descriptions of the various marshlands in San Francisco Bay are not abundant in scientific literature. Studies of marshland vegetation and ecology are more prevelant on the East Coast of the United States and in Europe (particulary England). To date, the most recent published account of salt marshes of San Francisco Bay found is by Hinde (1954), preceeded by Cooper (1926).

Hinde's study area was immediately north of the Palo Alto Yacht Harbor, in the near vicinity of Faber Tract Marsh. This marsh studied by Hinde was built upon the alluvial fan of San Franisquito Creek. Hinde noted that the development of salt marshes on alluvial fans may be a characteristic peculiar to San Francisco Bay. Three main types of vegetational associations were found by Hinde:
1) *Salicornietum* - with the dominant species being the glasswort *Salicornia ambigua* in the 10.4 - 6.41 ft. above M.L.L.W.;
2) *Spartinetum*, with the cordgrass *Spartina leiantha* being dominant within the 8.4 - 5.4 ft. level above M.L.L.W.; and
3) *Distichlidetum*, with *Distichlis spicata* in the 10.3 - 7.15 ft. above M.L.L.W. being the dominant vegetation. Although the marsh vegetation was summarized as above, Hinde could not clearly define the upper and lower marsh zones, since nearly all levels were submerged during nearly all high tides. The division of upper and lower marsh zones is commonly performed for salt marshes in Europe and the East Coast of the United States. Hinde identified a total of 10 species occurring throughout the marsh.

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4.1 MARSH DESCRIPTION

The three marsh areas selected for the Diffuse Source Loading Evaluation may be considered as closed marshes. A closed marsh is one where the tide rapidly enters through a narrow channel. Open marshes have a wide frontage exposed to the sea. Closed marshes induce rapid silting because of the tidal waters rushing through the channels, then quickly slowing down, depositing silt over a wide area.

To assist in the description of the marshes, a series of aerial photographs was taken in April, 1978. The photographs of Faber Tract Marsh and the upstream area of Mowry Slough had to be taken at an oblique angle due to ongoing air traffic. Selected photographs have been included to represent the three marsh areas.

4.1.1 Newark Slough

Newark Slough extends inland a little more than five miles. The sampling site was located approximately four miles from the Bay (Fig. 3). The bottom topography of the sampling site, as measured by a recording fathometer, is shown in Fig. 13 (Section 4.3.1). The recent aerial photographs showed greater marsh coverage than indicated by the USGS, 1961 quadrangle map. Along its entire length, both sides of the slough have marsh extending to the salt pond dikes. The upper reach of the slough, between Jarvis Landing and where the slough connects with a golf course, is marsh. The slough is connected to the golf course underneath Thorton Avenue. Observations from land indicated that water from Newark Slough is used to fill some of the water traps

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in the golf course. Also, the small salt evaporation pond at the upper end of the slough was apparently not in use, and that vegetation was growing in this area. The photographs showed that the area south of the Southern Pacific Railroad, on the eastern side of the slough, is also marsh. The distance inland that this marsh extends could not be determined from the photographs.

Figure 3 typifies the Newark Slough Marsh. There are many tributaries, some of which can be several feet deep, in the marsh. These assist in marsh draining and flooding, particularly the area near the salt pond dikes. During the October, 1977 sampling, a relatively high tide occurred, flooding the entire marsh area shown in Fig. 3.

4.1.2 Mowry Slough

The aerial photographs and observations from land revealed that the six mile length of Mowry Slough has marsh along both sides. The sampling site was five miles from the bay, and is shown in Fig. 4. The bottom topography of the sampling site is shown in Fig. 12 (Section 4.3.1.) As with Newark Slough, many tributaries in the marsh assist in flooding and draining. During the October, 1977 sampling, the high tide flooded the entire marsh to the salt dikes (Fig. 4). The upper reach of Mowry Slough is now marsh, instead of a salt pond (Fig. 5), as indicated in the USGS maps. A housing development, also not shown in the USGS maps, now exists in this area. Figure 6 shows marsh alongside the Southern Pacific Railroad.

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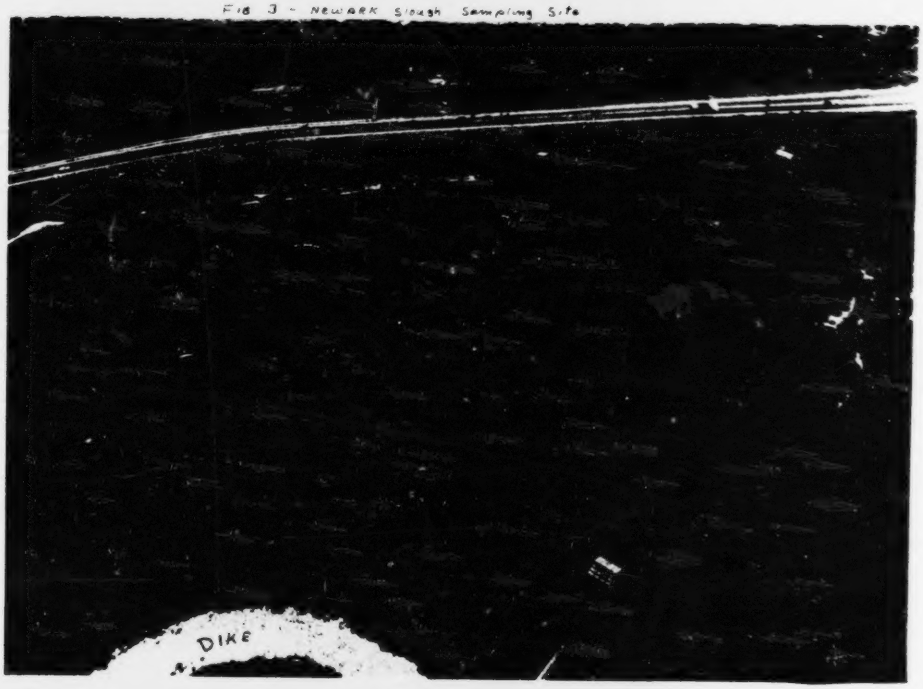
Roll 1
#19

Fig 3 - NEWARK Slough Sampling Site



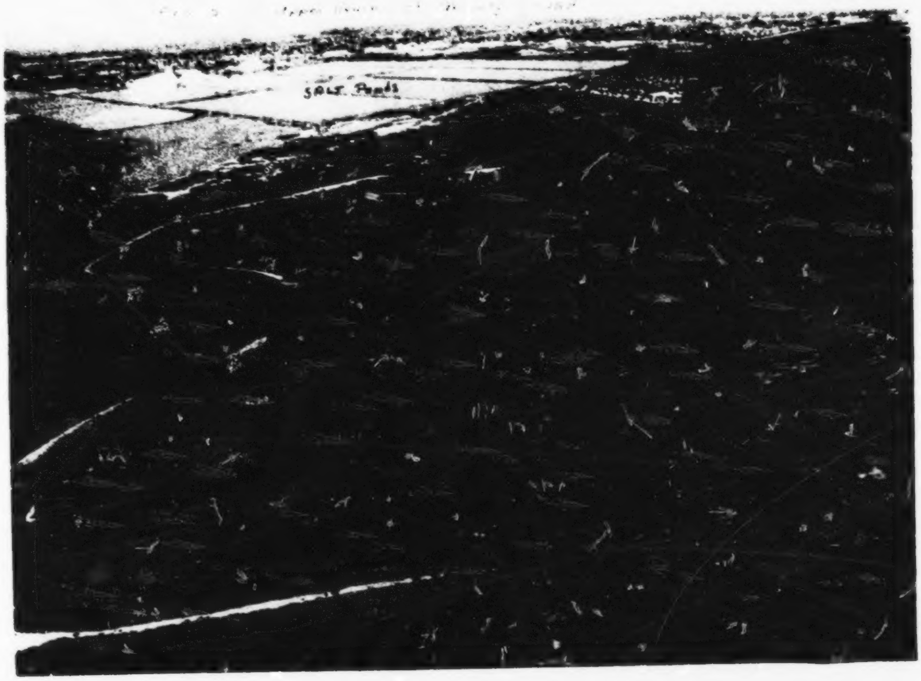
Roll 2
#20

Fig 4 Mowry Slough Sampling Site

Roll 2
#22

[illegible] Upper Reach [illegible]

16



Roll 2
#19

[illegible] Upper Reach of [illegible] Slough [illegible] Area

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4.1.3 Faber Tract Marsh

The 1961 USGS map shows Faber Tract Slough as being entirely mud. Infrared aerial photographs of this area clearly show an extensive marsh. A representative illustration of Faber Tract Marsh (Fig. 7) was compiled from several of the photographs (Figs. 8-11). The diking around Faber Tract Marsh suggests that this was designed as a salt evaporator pond. According to Hinde (1954) by 1929, 270,000 cu. yds. of mud was deposited from the construction of the Palo Alto Yacht Harbor in the area north and west of the yacht basin. In 1936, levees were raised around much of the shoreline of the Bay, resulting in 240 acres in which the silt from San Francisquito Creek was deposited. Since 1949, large sections of the diking has eroded, allowing the sea to gain access to the impounded area.

In general, Faber Tract Marsh is triangular in shape, with the sampling site located at the mouth of the marsh, or apex of the triangle, adjacent to the bay. The bottom topography of this sampling site, shown in Fig. 14 (Section 4.3.2), and does not at all represent the topography of the marsh.

Faber Tract Marsh is basically a basin, with marsh vegetation on the bottom and continuing up along the sides to the dikes. Our observations indicated that there is only one entrance and exit for bay water, this being where the sampling site was located. From the aerial photographs, it is evident that the many tributaries allow for substancial marsh flooding.

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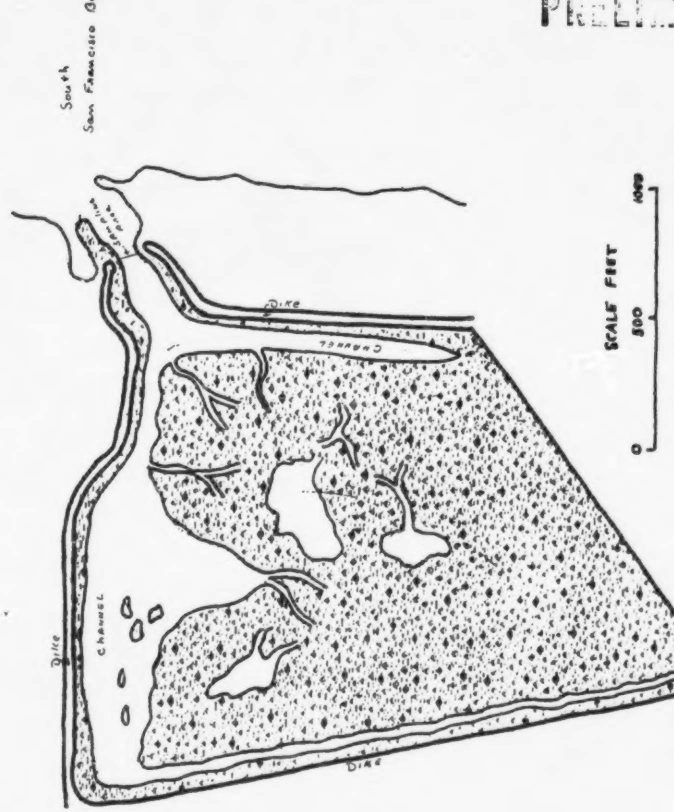

Fig. 7
Faber Tract Marsh

Fig 8 Faber Tract MARSH

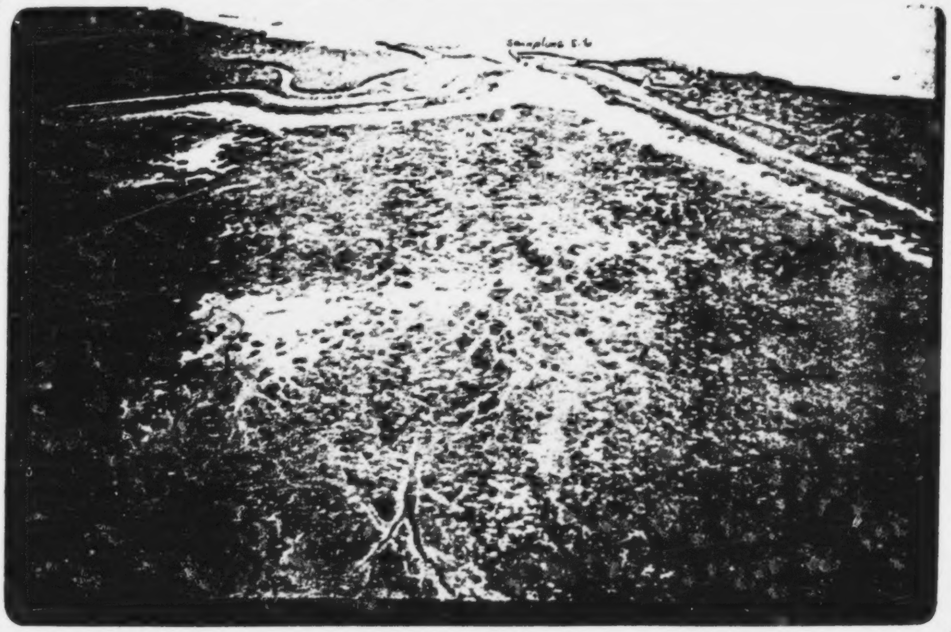

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Fig 9 FABER Tract MARSH

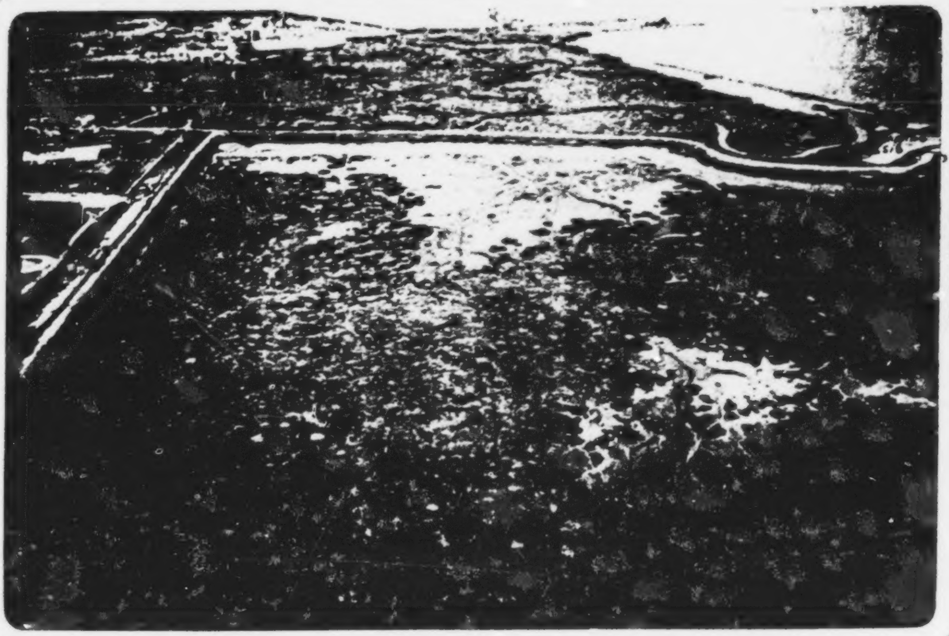

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Fig 10   Faber Tract MARSH

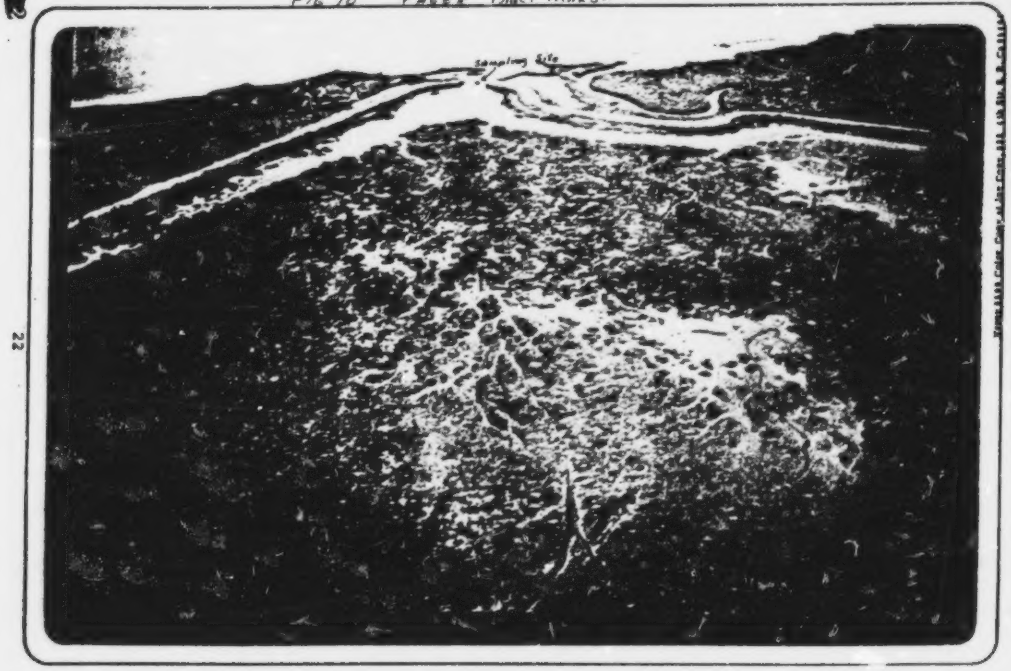
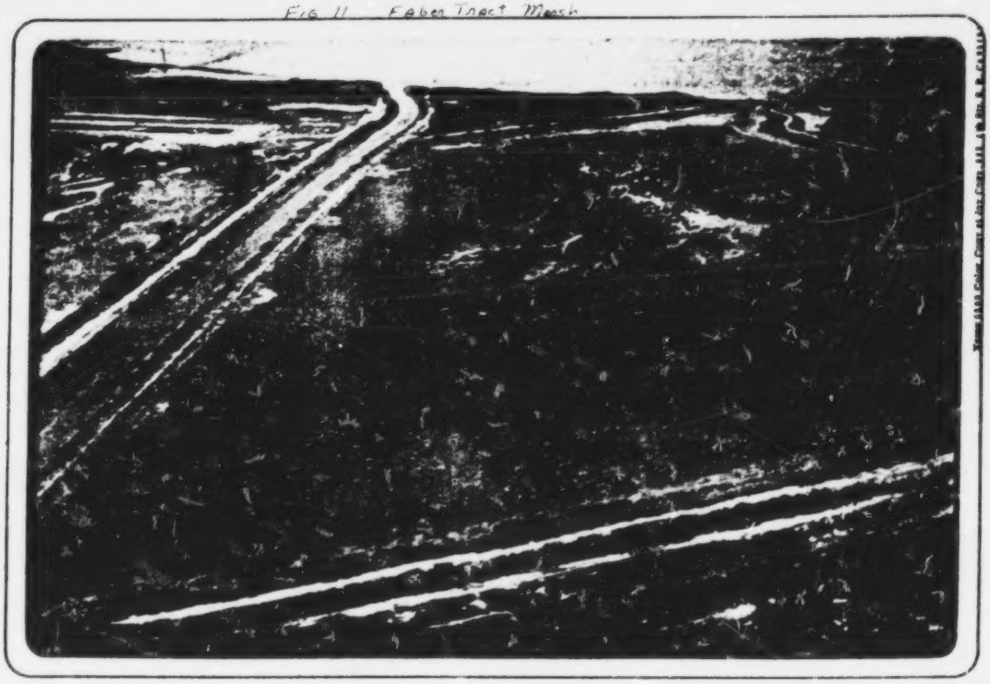

Sampling Site

Fig 11   Faber Tract Marsh



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Parts of the marsh in this basin flood every day. However, the amount of area flooded could not be determined (Section 4.3). The sampling site was located at the opening in the levee approximately 12 ft. above the slough bottom. With sampling occurring every hour, it was infeasible for the sample collector to drive around the marsh to make the necessary measurements for areal flooding.

4.1.4

Wide variations in flow rate were measured in each slough. Appendix I summarizes the slough hydrology data, where neutrally buoyant drifter bottles were used as water velocity indicators. Range of flow rate for each slough were: 5.13-363.8 cfs for Mowry Slough; 11.4-591 cfs for Newark Slough; and for Faber Tract Marsh, <5-840 cfs. Observation of maximum flow rates generally occurred during the tidal period from high-high to low-low. Observations showed that the water movement in the sloughs was very similar to rivers and streams, with reversed eddie currents occurring near shore. Water striking projections of the slough bank would result in sediment erosion. Times of least water clarity were observed to coincide with the high flow rates; probably a result of bottom and slough bank sediment resuspension, and suspended particles in the bay water entering the slough.

4.1.5

Appendix II shows the wide variations of non-filtrable and filtrable residue. As previously mentioned, the water clarity appeared to decrease during high flow rates. During slack water the sampling

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site in Faber Tract Marsh, a brown film presumably sediment, covered relatively large portions of the water surface, and would be carried into or out of the marsh as the flow rate increased.

The bottom sediment in each slough was very soft. In fact, at Mowry and Newark Sloughs, it was virtually impossible to walk on the slough bottom without a platform for support. At the end of a days' sampling, these platforms were usually several inches below the sediment surfact.

4.1.6

Field observations showed that Faber Tract Marsh was the only area with visable marine life inhabiting the marshland. During low tides, the gastropod *Nassarius obsoletus* would graze at the water's edge. This species appeared to be the most abundant marine macroinvertebrate present. The bivalve *Ischadium demissum* occurred in small numerous patches in the higher marsh elevations not flooded by sea water every day. Other fauna included amphipods, inhabiting water filled depressions in the marsh; and the isopod *Gnorimosphaeroma* sp., which bored into the hard packed mud bank of the levee at the sampling site. The dominant vegetation, in all three areas, appeared to be *Salicornia*.

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4.2 MARSH COVERAGE

General observations of the marsh at each of the three slough sampling sites were made during the study period. The most recent USGS maps available for South Bay were revised in 1961. It was evident from our observations (Section 4.1) that there is more marsh area surrounding each slough than indicated by these maps. Therefore, a series of aerial photographs, taken in April, 1978, were used to up-date the USGS map for marsh area at each slough.

The up-dated USGS maps were used to calcualte marsh area at each slough. Since the marsh at the mouth of Newark Slough extends to the Bay, the downstream marsh area calcualtions were terminated at 37° 30' 22" latitude (junction of Newark Slough and Plummer Creek). These calculations are summarized in Table I.

Hydroscience also computed upstream marsh coverage. Because of difficulties encountered in helicoptor scheduling for the aerial photography, the submission of photo up-dated maps of the study area could not be effected in time for Hydroscience to use these maps for the calculation of marsh area.

Except for Mowry Slough, there is good agreement between our calculation of marsh area, and those made by Hydroscience. The large difference (0.59 mi^2) for the upstream marsh area in Mowry Slough is most likely the result of the added marsh area revealed in the aerial photographs (Section 4.1.2).

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TABLE 1

CALCULATED MARSH AREAS

BASED ON USGS MAPS and 1978 AERIAL PHOTOGRAPHS

Location	Marsh Area Upstream of Sampling Site (mi^2)	Marsh Area Downstream Sampling Site (mi^2)	Total Marsh Area (mi^2)
Mowry Slough	0.89 (0.3)*	0.47	1.36
Newark Slough	0.13 (0.2)*	0.77	0.70
Faber Tract Slough	0.09 (0.1)*	0	0.09

* Estimated marsh area upstream by Hydroscience, Inc.

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4.3 MARSH SUBMERGENCE

Estimates of the frequency of marsh submergence for Mowry and Newark Sloughs have been made in the following manner. On several occasions, the water depth, as obtained from the stage rod, was observed when the marsh surrounding the sampling site was beginning to flood. A time-height at the Golden Gate was calculated by examining the hydrological data (Table II). This data, along with the field observations of slough depth at marsh flooding, was used to estimate submergence frequency for each slough (Table III). It should be noted that the field observations of slough depths and marsh flooding were made as general observations, since marsh submergence frequency was not required in the project specification. We realize that in order to obtain accurate and reliable calculations of the frequency and area of marsh submergence, detailed measurements of marsh tidal heights would have to be made.

4.3.1 Mowry and Newark Slough

The bottom topography at the sampling sites (Figs. 12-13) typifies that of the main channel for Mowry and Newark Sloughs. The surrounding marsh is a relatively flat expanse on both sides of the channel. There is very little, if any, marsh vegetation on the banks of the channel. Therefore, when the water depth reaches the top of the channel, only a few more inches of water depth are required to flood much of the marsh.

4.3.2 Faber Tract Marsh

The bottom topography of the sampling site (Fig. 14) does not at all reflect the topography of this marshland. As previously de-

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TABLE II

Slough Depth to Tide Height Corrections

Time and Depth Corrections Compared to Golden Gate

August-November, 1977

		Time Correction hrs.	Height Correction* ft.
MOWRY SLOUGH			
	High Water	+1.5	+2.8
	Low Water	+1.5	+1.5
NEWARK SLOUGH			
	High Water	+1.75	+2.0
	Low Water	+2.0	0.0
FABER TRACT MARSH			
	High Water	+1.5	+3.4
	Low Water	+2.0	+0.2

*Correction values to be added to tidal heights at Golden Gate to obtain water depth in slough.

TABLE III

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FREQUENCY OF MARSH SUBMERGENCE

	Slough Depth for Marsh Flooding	Golden Gate Tide Height
MOWRY SLOUGH	8.0 ft.	5.2 ft.
NEWARK SLOUGH	8.0 ft.	6.0 ft.
FABER TRACT MARSH	?	?

Number and (%) of High Tides that Equal or Exceed Depth for Flooding.

MONTH	MOWRY SLOUGH	NEWARK SLOUGH	TOTAL POSSIBLE
Aug., 1977	34 (56.7)	7 (11.7)	60
September	34 (58.6)	0 (0)	58
October	24 (40.0)	4 (6.7)	60
November	24 (41.4)	10 (17.2)	58

Number and (%) of Days in Which Tides Equal or Exceed Depth for Flooding.

MONTH	MOWRY SLOUGH	NEWARK SLOUGH	TOTAL POSSIBLE
Aug., 1977	30 (96.8)	7 (22.6)	31
September	26 (86.7)	0 (0)	30
October	22 (70.9)	4 (12.9)	31
November	24 (80.0)	10 (33.3)	30

These calculations refer only to the four months of the study. It is evident from this table that Mowry and Newark Sloughs do not flood every day, and that generally, only one of the two daily high tides occurring in San Francisco Bay will cause marsh flooding. Although partial marsh flooding occurs daily in Faber Tract Marsh, the extent of areal submergence depends on the daily tidal cycle. For all three marsh areas, the duration and extent of marsh submergence is dependent on the daily tidal cycle.

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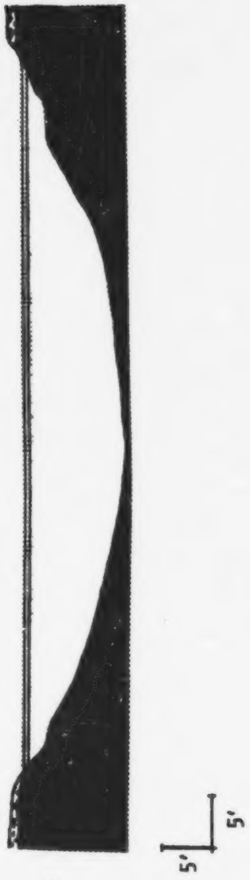

FIG. 12
MOWRY SLOUGH
BOTTOM TOPOGRAPHY OF SAMPLING SITE

FIG. 13

NEWARK SLOUGH

BOTTOM TOPOGRAPHY OF SAMPLING SITE

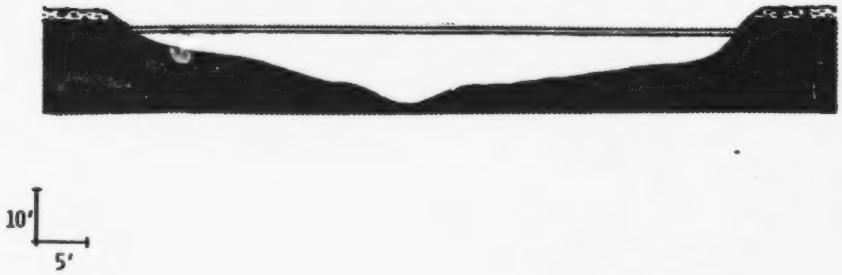

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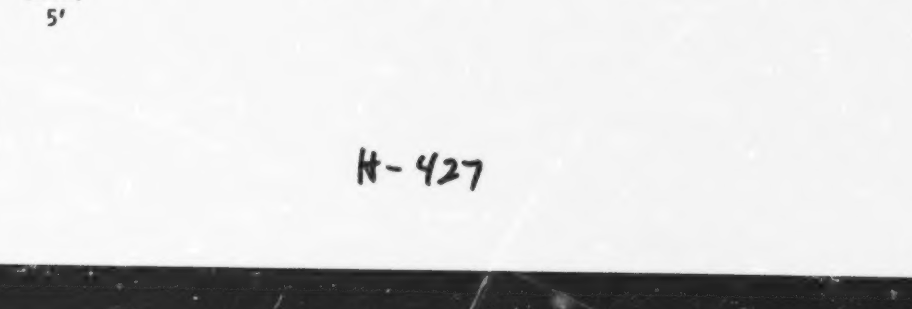
FIG. 14

FABER TRACT MARSH

BOTTOM TOPOGRAPHY OF SAMPLING SITE



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scribed (Section 4.1.3), the marsh area is somewhat triangular in shape, with the sampling site located at the apex. Only limited observations of marsh flooding could be made. Very little of the marsh was visible from the sampling site. What was noted was that partical flooding of the marsh occurred during each sampling effort. The degree of marsh flooding could not be determined.

4.3.3

It is evident that daily marsh flooding at Mowry and Newark Slough did not occur during the four months of the study (Table III). San Francisco Bay has a mixed semi-diurnal tidal cycle, generally resulting in two high and two low tides each day. For both Mowry and Newark Sloughs, the percent number of days for flooding was generally twice as great as the percent number of high tides required for flooding. Therefore, when flooding does occur, only one of the two high tides per day are generally high enough to cause marsh flooding. However, there were some days during the study period in which both high tides would cause marsh flooding, conversly there were days in which no marsh flooding occurred.

As indicated in this Table, no estimates of marsh flooding were made for Faber Tract Marsh. As described in Section 4.1.3 only parts of Faber Tract Marsh flood every day, but the extent of aeral marsh flooding could not be determined.

Since daily marsh flooding does not occur at Mowry and Newark Sloughs, accurate estimates of marsh submergence necessitates ex-

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amining the daily tidal cycle. Parts of Faber Tract Marsh will flood daily, but the extent of marsh flooding also depends on the daily tidal fluctuations. Therefore, for all three marsh areas, the duration and extent of marsh submergence is directly related to the daily tidal cycle.

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4.4 DISSOLVED OXYGEN and SALINITY OF SLOUGHS

Examining the dissolved oxygen (D.O.) and salinity data revealed that a distinct pattern for both parameters occurred in each of the three sloughs sampled. These patterns occurred during each sampling effort, indicating that they were not a result of random variation or a rare occurence.

4.4.1 Mowry Slough

The salinity and D.O. measurements for each sampling effort are summarized in Figs. 15-18. It is evident from these figures that no clear, recurrent trends in D.O. fluctuation occurred throughout the study. In general, D.O. ranged between 3-5 ppm during each day of sampling. Salinity, however, did have one apparent trend. Salinities rapidly and substantially increased as the tide was incoming, and similarly decreased on the outgoing tide. In several cases the salinity changed over 10 ppt during a sampling day. Salinities typically ranged from about 19-30 ppt. Daily variation of salinity was most pronounced in Mowry Slough when compared to Newark Slough and Faber Tract Marsh. This daily salinity variation and range of salinity values were also quite similar throughout the four months of sampling. There was no rainfall immediately prior to, or during sampling which could have contributed to this phenomenon.

FIG. 15

MOWRY SLOUGH

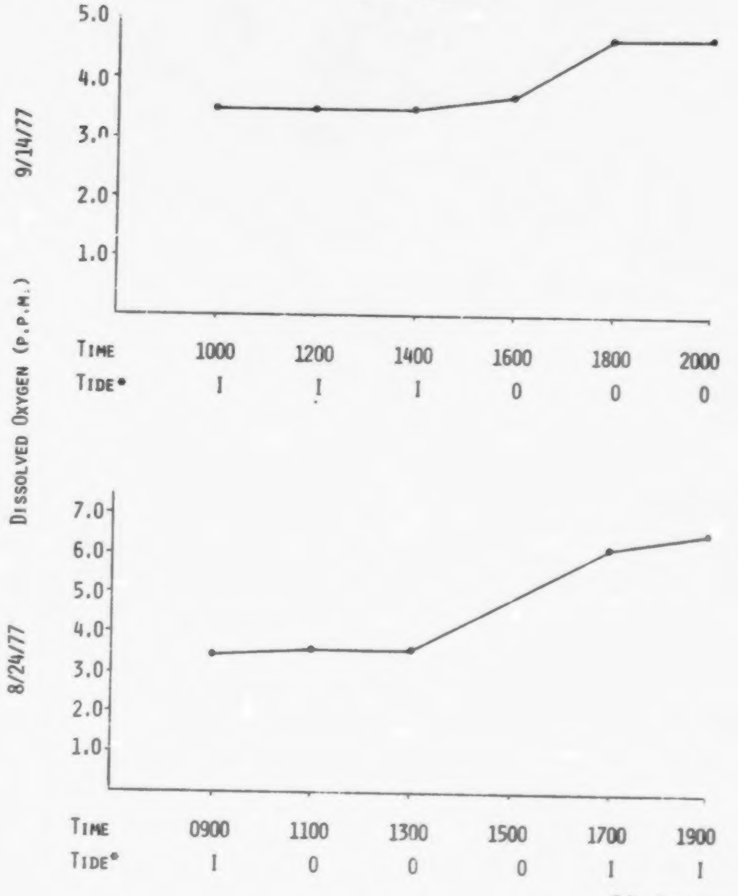


FIG.16

MOWRY SLOUGH

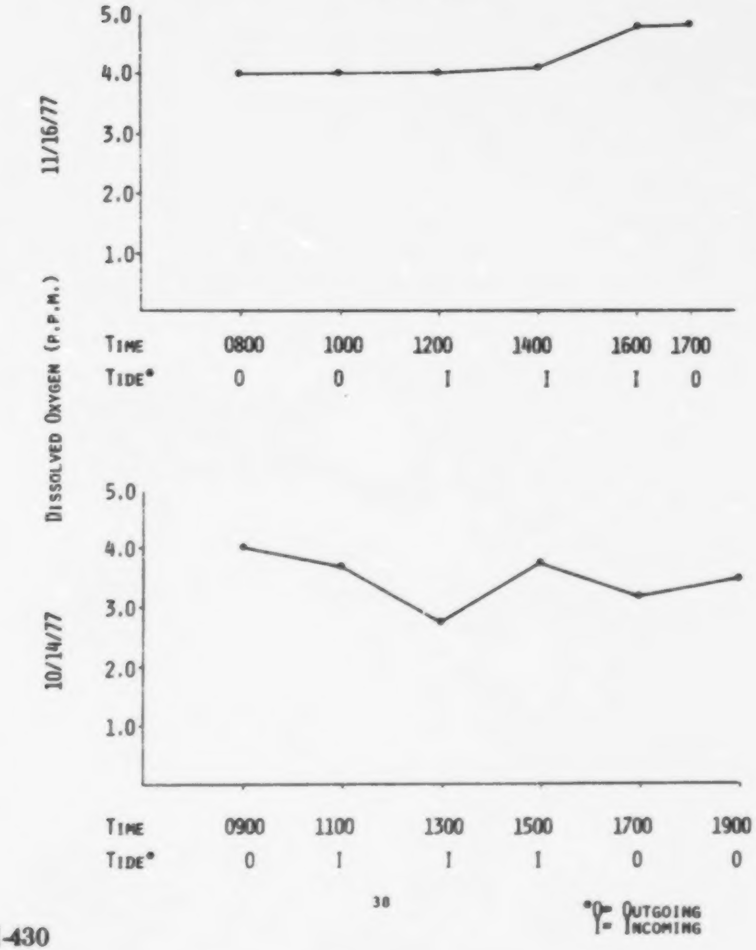


FIG. 17

MOWRY SLOUGH

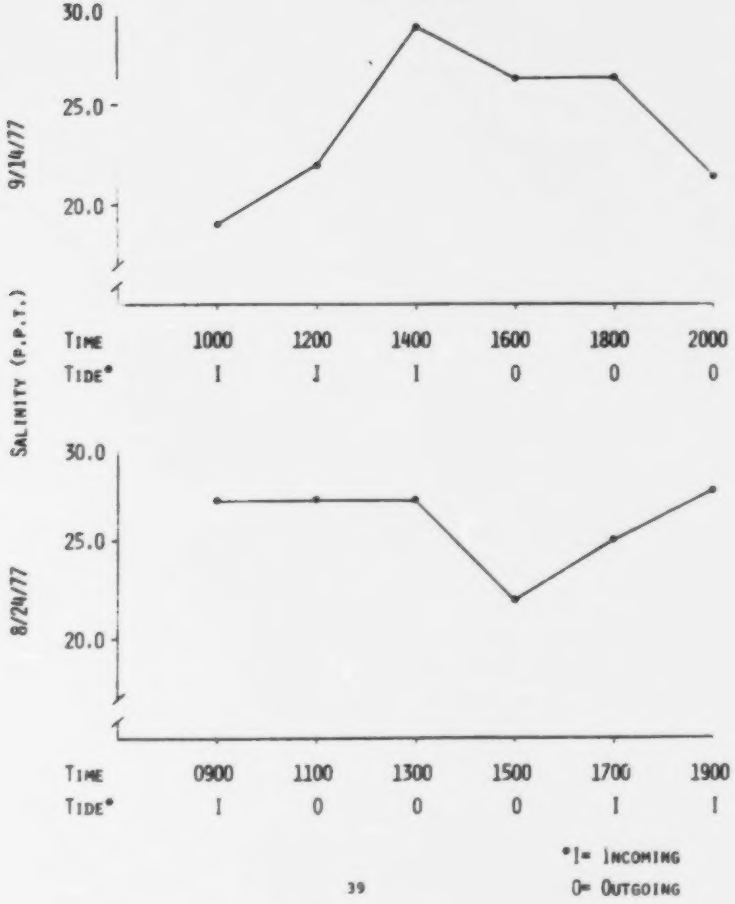
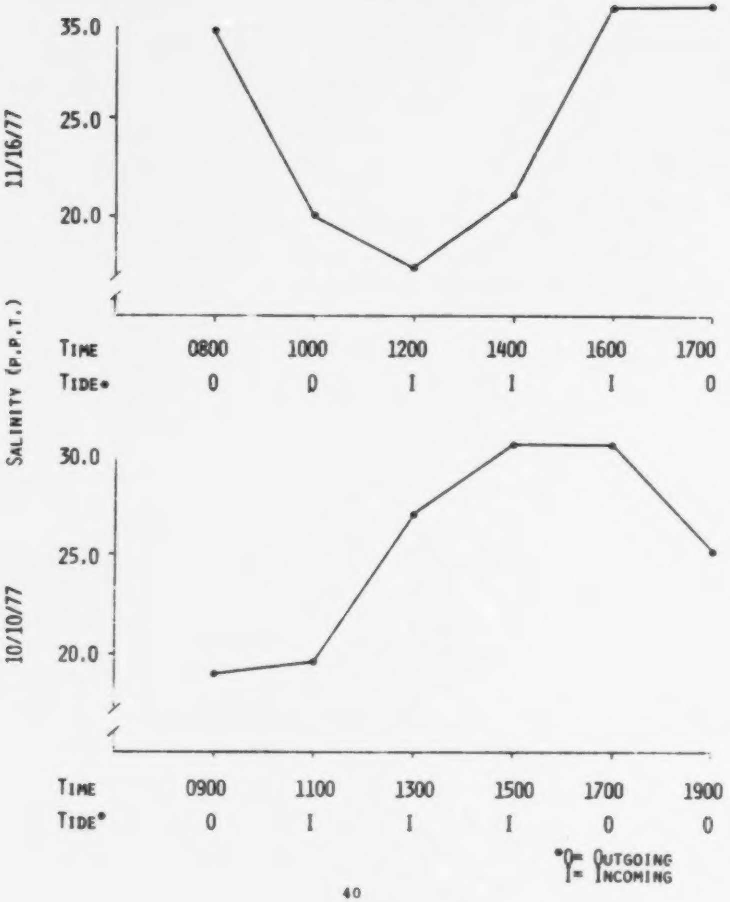


FIG. 18

MOWRY SLOUGH



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4.4.2 Newark Slough

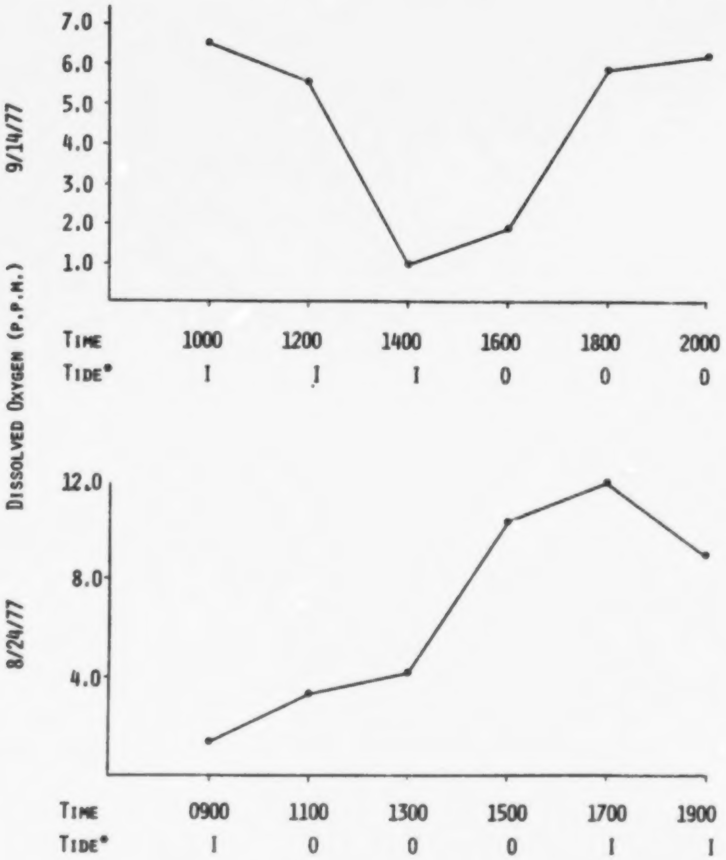
During the four sampling efforts, D.O. had wide fluctuations. Maximum variation of D.O. occurred in August, 1977 where the D.O. ranged from 1.4 to 11.9 ppm (Figs. 19-20). A recurrent trend in D.O. values was observed relative to the incoming and outgoing tides. During all four days of measurements for D.O., D.O. values would decrease during the incoming tide and increase during the outgoing tide. The magnitudes of change for D.O. varied among the sampling days. For example, total net increase during the sampling day in November, 1977 ranged from 1.2 - 2.5 ppm; and in September, 1977 from 1.5 - 11.9 ppm.

These data also clearly demonstrate that vertical stratification of D.O. occurred in Newark Slough. A vertical profile of D.O. was made in October, 1977. It is evident from Fig. 18 that the mid-depth D.O. values were all proportionally lower than the near-surface values. It is not known if D.O. stratification occurred at the mouth of the slough which was four miles from the sampling site.

From September-November, 1977, the trend of salinity fluctuation in Newark Slough was opposite to that observed from Mowry Slough; but to a much lesser degree (Figs. 21-22). As the tide entered Newark Slough, the salinities would depress slightly (2-3 ppt) from the maximum, and increase similarly on the receding tide. In general, the salinity values throughout the study ranged from 28-32 ppt for each day of sampling.

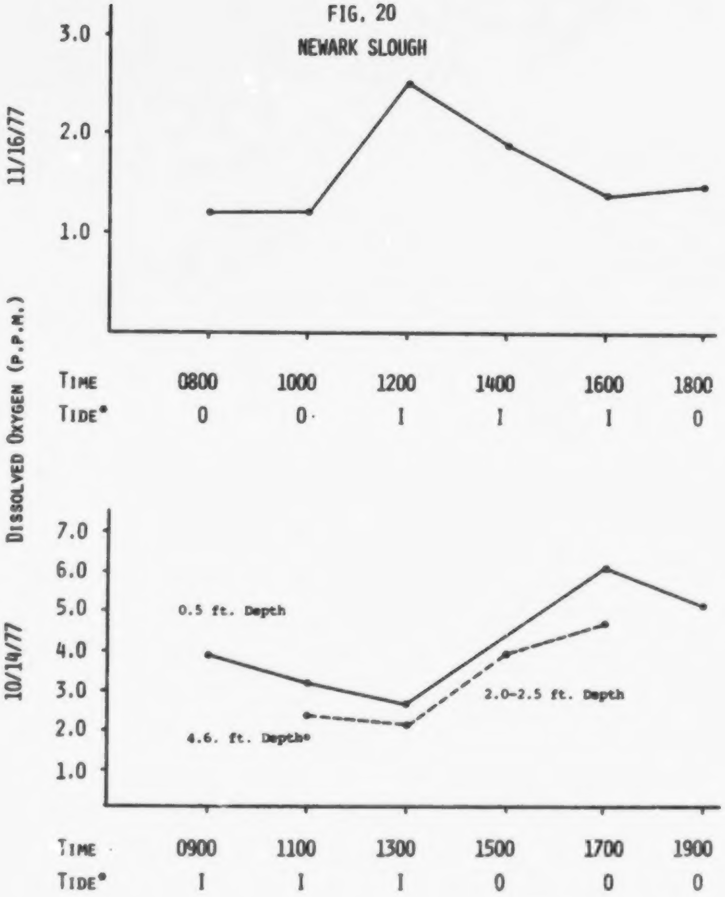
FIG. 19

NEWARK SLOUGH



*I- Incoming
0= Outgoing

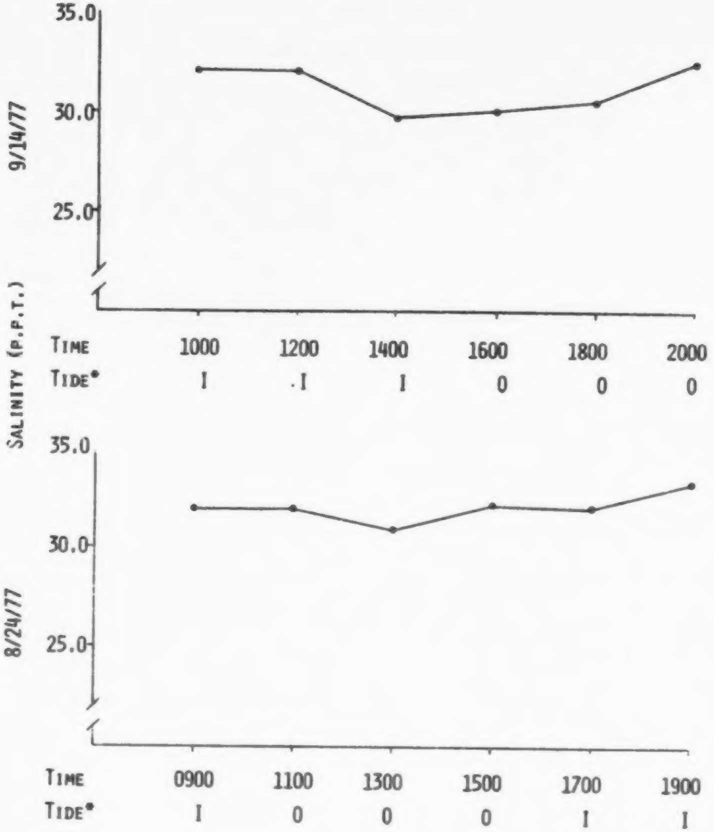
FIG. 20
NEWARK SLOUGH



*I= Incoming
0= Outgoing

FIG. 21

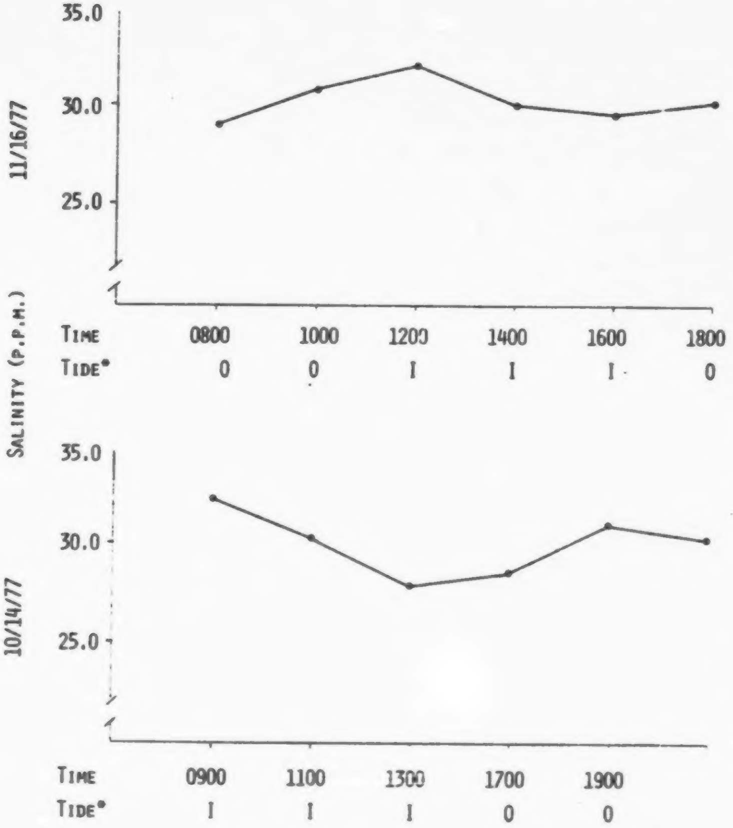
NEWARK SLOUGH



*I= INCOMING
0= OUTGOING

FIG. 22

NEWARK SLOUGH



*I= INCOMING
0= OUTGOING

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4.4.3 Faber Tract Marsh

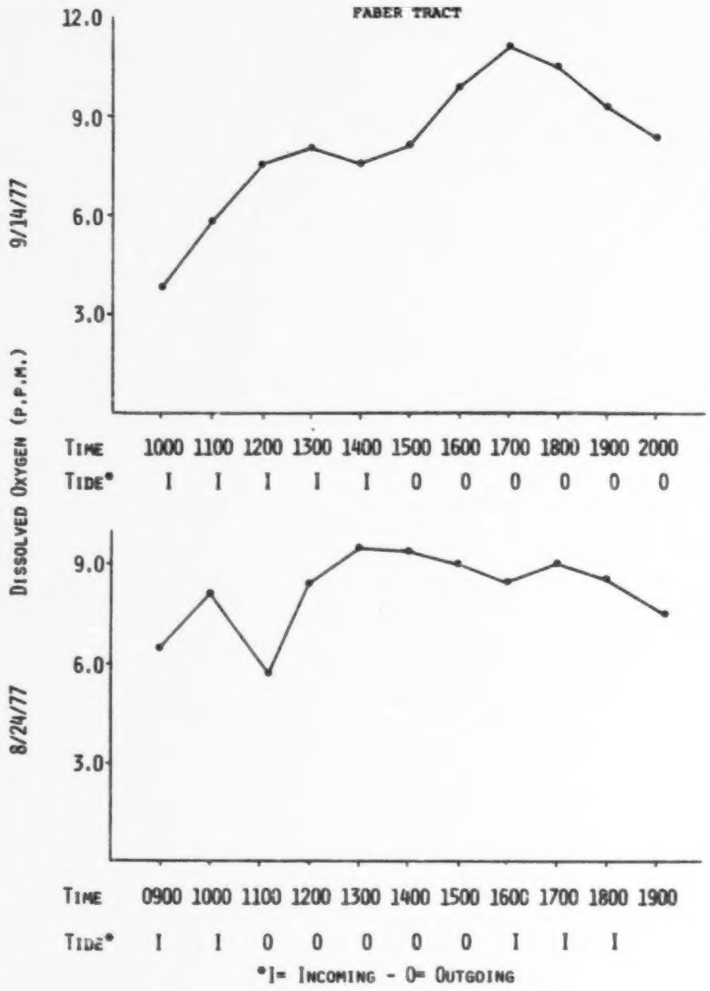
The D.O. regime in Faber Tract Marsh was unique when compared to Newark and Mowry Sloughs (Figs. 23-24). As the tide was incoming, D.O. increased by several ppm. As the tide reversed, the D.O. was initially depressed, then the D.O. increased again by an additional several ppm until the maximum D.O. value was recorded at approximately half way through the ebb tide cycle. During the last half of the ebb tide, the D.O. then decreased. The D.O. at the end of sampling was always higher than the D.O. at the start of sampling. This description occurred for all four sampling dates. The beginning and ending D.O. values, and range of D.O. fluctuation per day differed among sampling efforts. For example, in August, 1977 the D.O. ranged from 3.6 - 11 ppm, with a beginning D.O. of 3.6 ppm and ending with 8.4 ppm. In September, 1977 the D.O. began and ended with 6.4 and 7.5 ppm respectively, and ranged from 5.5 - 9.4 ppm.

The salinity values for Faber Tract Marsh were relatively constant; during each day of sampling and among sampling efforts (Figs. 25-26) they averaged about 30 ppt, generally with minor fluctuations of 1 ppt around the mean.

4.4.4.

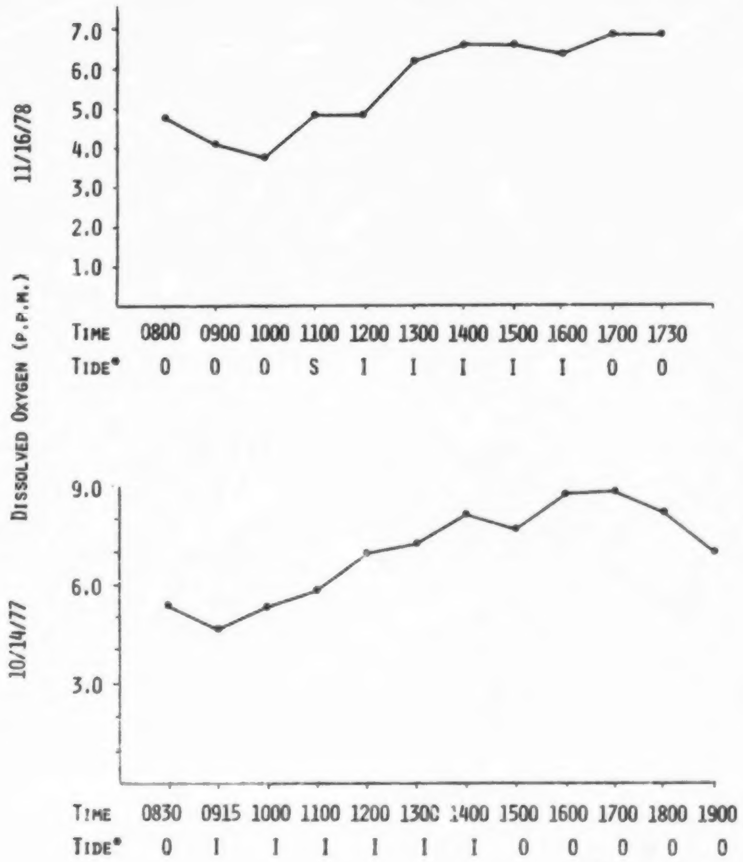
The D.O. regime in each slough cannot be explained as easily as the salinity. All of the water quality parameters measured generally affect D.O. in a variety of methods, to some degree. An attempt was made to determine if, in fact, any one of the water quality parameters could easily be identified as having a dominant effect on D.O. A

FIG. 23


FABER TRACT

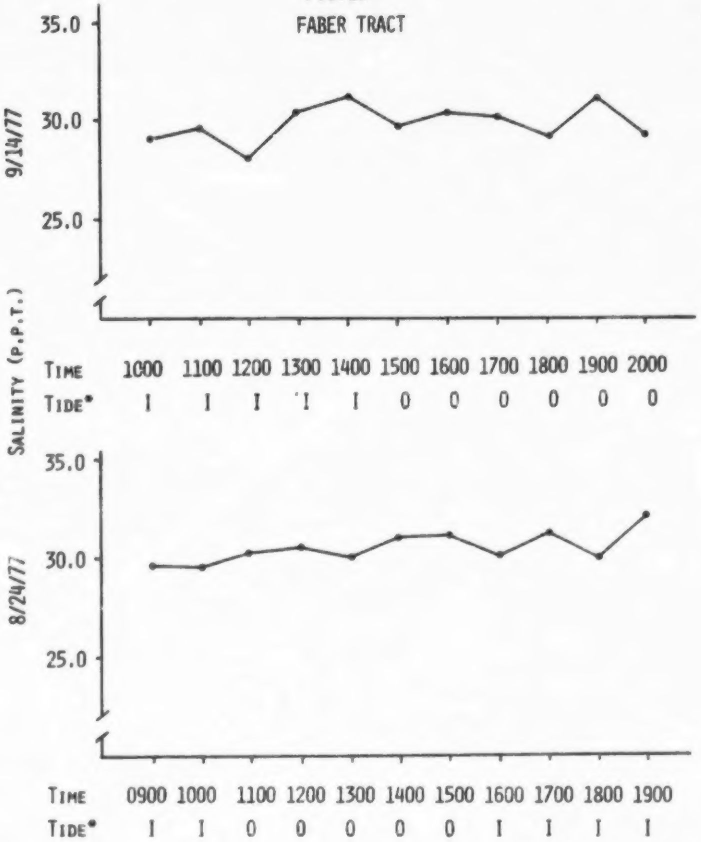
*I= INCOMING - 0= OUTGOING

FIG. 24
FABER TRACT MARSH



*0= OUTGOING
I= INCOMING
S= SLACK

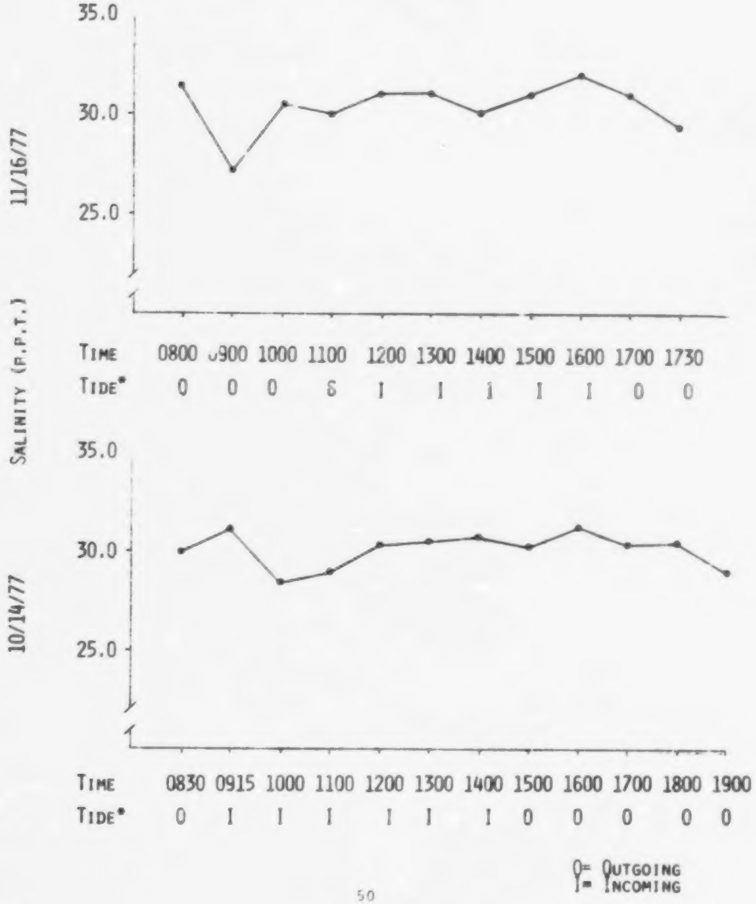
FIG. 25
FABER TRACT



*I= INCOMING
0= OUTGOING

FIG. 26

FABER TRACT



variety of parameters was selected, for which linear correlations between D.O. and each parameter in each marsh area were performed. The results of these correlations are summarized in Table IV. These results show that none of the individual water quality parameters selected can be isolated as having a continual dominant effect on D.O. If these selected water quality parameters do substantially affect D.O., then they must do so in a relatively complex manner involving several parameters; thus, the use of any one parameter is not suitable for linear predictions of D.O.

It is evident that there was a separate D.O. and salinity regime occurring in each of the three marsh areas studied. The daily salinity pattern in Mowry Slough could easily be explained by a fresh-water input upstream of the sampling site. The salinity routinely decreased during incoming tides in Newark Slough. This is probably a result of the Union-Newark discharge, which enters Newark Slough approximately 3/4 mile upstream from the Bay. The salinity in Faber Tract Marsh was relatively stable. Since the sampling site was very close to the Bay, the salinity in Faber Tract Marsh was probably dependent on the salinity of the Bay.

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TABLE IV

SIGNIFICANT CORRELATIONS

D.O. versus SELECT PARAMETERS

	Chlorophyl a	Total Dissolved Sulfide	Ammonia Nitrogen	Organic Nitrogen	Nitrite	Nitrate
MOWRY SLOUGH						
August	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
September	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
October	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
November	N.S.	N.S.	+	N.S.	+	N.S.
NEWARK SLOUGH						
August	N.S.	+	N.S.	N.S.	-	-
September	N.S.	-	-	N.S.	N.S.	N.S.
October	N.S.	N.S.	N.S.	X	N.S.	N.S.
November	N.S.	-	N.S.	N.S.	N.S.	N.S.
FABER TRACT SLOUGH						
August	N.S.	N.S.	N.S.	N.S.	+	N.S.
September	N.S.	-	N.S.	N.S.	N.S.	N.S.
October	N.S.	+	N.S.	N.S.	N.S.	N.S.
November	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S. = not significant (-) = significant negative correlation coefficient

Level of Significance = 95% (+) = significant positive correlation coefficient

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4.5 SUMMARY

Much of the work in salt marsh description and ecology has been done in Europe and along the Alantic Coast of the United States. From these studies, a variety of "standard" descriptions and ecological considerations of marine marshlands have evolved. Marshland descriptions include, for example: submergence or emergence zones classified by zonation of the marsh vegetation as a function of tidal height, and open or closed marshes. Also, as stated by Ranwell (1972), "Any particular marsh may be intermediate in character between the three main types distingushed: spit-associated marshes; embayed marshes; estuarine marshes. So long as the various gradients: exposure; soil particle size; salinity; are kept in mind, there should be no difficulty in placing the marsh in the ecosystem of which it forms a part. It is essential to consider the system as a whole when interpreting results from the study of any part of it."

The unique configuration of the San Francisco Bay system, coupled with two distinct wet and dry seasons normally occurring each year, complicates classification of the marshes. The marshlands of South Bay could potentially be classified in a variety of ways. The three marsh areas studied are basically closed marshes, but open marshes do occur widely as indicated by the aerial photographs. From the hydrological composition of South Bay, it may be inferred that embayed marshes exist, with the degree of embayment affected by the amount of fresh water discharged into the sloughs. However,

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the distinct rainy season may create certain estuarine conditions part of the year. An examination of the frequency of marsh submergence may indicate that Mowry Slough approximates a near submergence marsh, with Newark Slough being more of an emergence marsh. If Faber Tract Marsh is similar to the marsh adjacent to the Palo Alto Yacht Harbor (as described by Hinde in 1954), with no clear division of upper and lower marsh zones, the marsh may not easily be classified as having submergence or emergence zones. There was a different salinity and D.O. regime occurring during all four sampling dates at each of the three different study areas.

The two year drought, just ended, may have had a considerable effect on the marshlands. Rainfall does affect the soil salinity in emergence marshes, and greatly contributes to marsh drainage. Considering the wet and dry seasons that do occur in this area, it is possible that different types of vegetation may occur in the marsh depending on the season. The recent drought may have created a situation where the marsh interstitial salinities remained high, thereby preventing survival of plants requiring very low interstitial salinity.

The drought ended with a record high rainfall. During the drought, it is probable that marsh draining would be minimal, allowing the material and nutrients commonly drained as a result of rainfall to build up. Then, with the high rainfall, the draining rate may have been quite high, removing much of the two year build-up in a few months.

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It is evident that the data required to accurately classify the marshlands surrounding the South Bay is not available from the field project, or from Hinde (1954). Depending on the type of marsh, there are relatively distinct ecological processes affecting marsh development, and possible differences in the exchange of nutrients between the marsh and sea water. An adequate description of these processes and interrelationships is beyond the scope of this report. These aforementioned differences do exist, and may play a significant role in the overall marsh ecosystem in South Bay.

As previously mentioned, the classification of marshes has evolved principally from studies in Europe and the East Coast of the United States. San Francisco Bay has traditionally been considered as a unique biological environment. The Bay may be classified as being a marine embayment, with seasonal estuarine characteristics depending on what part of the Bay is being considered. Also, depending on the season (wet or dry), strong gradients of physical parameters exist, as well as relative uniformity of these same parameters. Our sampling throughout the Bay over the past several years has shown this to be true. It is possible that the standard system of marsh classification may or may not be suitable for South San Francisco Bay.

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BIBLIOGRAPHY

Cooper, W. S. 1926 Vegitational development upon alluvial fans in the vicinity of Palo Alto, California. Ecology 7:1-30.

Hinde, Howard 1954 Salt marsh phanerogams in relation to tide levels. Ecol. Mono. 24(2): 209-244.

Kelly & Tippets 1977 Delta outflow and San Francisco Bay. Prepared for the Delta Environmental Advisory Committee of the California Department of Water Resources.

Nichols, Fredrick H. 1977 Ecology of Marine Benthos, ed. by Bruce Coull. University of South Carolina Press. pp: 319-338.

Ranwell, D. S. 1972 Ecology of Salt Marshes and Sand Dunes. John Wiley & Sons, Inc. New York. 250 pp.

Smith, E. H. & Associates 1977 Benthic survey and water quality sampling program. Prepared for South Bay Dischargers Authority Wastewater Disposal Project, submitted to Bechtel, Inc.

U.S.G.S. 1978 Preliminary data from the Water Quality Monitoring Network for San Francisco Bay.

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5.0 BENTHAL DEMAND

5.1 INTRODUCTION

The benthal demand analysis was to provide input for the model representing chemical interactions between the various sediment types within the South Bay and the overlying waters. The benthal demand analysis may be more descriptively termed oxygen uptake: incorporating both biological and chemical processes. The application of a benthal demand analysis to this type of study is relatively new. The authors (Pamatmat, 1975; Smith, K. L., 1974; Smith, K. L., et al. 1976) of these studies have stated a variety of major considerations in performing this technique, and that the entire experiment is unproven with respect to the precision of measurements. Therefore, the measurement of oxygen uptake by biological communities and chemicals in the substrate, is still in a "state of the art" stage.

Previous studies have been performed "in situ" in deep marine waters using sophisticated sampling gear and underwater television camera to insure core samples with little or no sediment-water interface disturbance. The sample cores were then immediately processed on board a large vessel. Replication of this technique in South Bay is not practical or financially feasible. Therefore, certain modifications of the equipment and analysis were designed for the South Bay study area.

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5.2 METHODS AND MATERIALS

The core samples were collected with a Trisk sampler and glass cores 4.9 cm. in diameter. The core was carefully inserted into the substratum to a depth of 16 cm. The core contained overlying water, and careful observation of the water-sediment interface was made to insure that the substratum was not disturbed. The cores were transferred immediately to a specially insulated container for the trip to the laboratory. Field temperature measurements were made of the overlying water, and the insulated containers were maintained at the field temperature. Three stations were sampled in duplicate for each of three specified incubation temperatures. The core samples were collected from the following areas: Faber Tract Marsh, at the Diffuse Source Loading Evaluation Station; Alviso Slough within sampling grid number 118 (Fig. 2); and the Palo Alto Harbor area. The cores were transported to the laboratory at a constant temperature (field temperature), and then transfered to the benthal demand chambers. At the time of transfer, the cores were again checked for sediment disturbance before placing them in the apparatus. We found no disturbance at the water-sediment interface in the field or after transport to the laboratory.

The benthal demand apparatus was constructed after a review of the literature so that the newer finding by Pamatmat (1971) and Smith (1974) could be incorporated. A schematic of the apparatus is shown in Fig. 27. The system operates in the following manner.

FIG. 27

SCHEMATIC DESIGN FOR BENTHAL DEMAND APPARATUS

R is a reservior for maintaining volume of sea water in a closed system when a sample volume is withdrawn.

Sa is the sample reservior

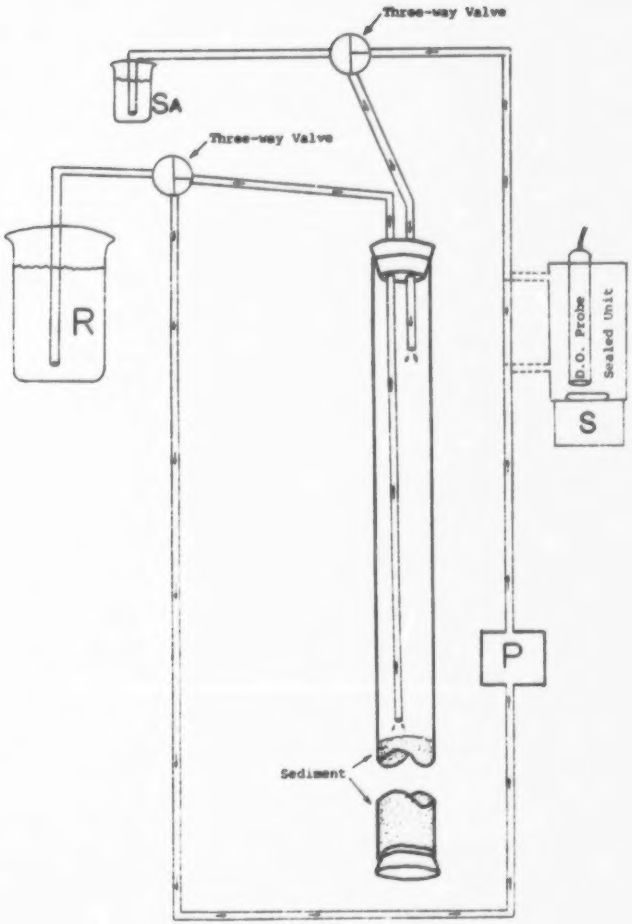
P is a peristaltic pump.

S is a magnetic stirrer.

The diagram illustrates the flow pattern when the system is closed and operating. To extract a sample, both three-way valves are opened simutaneously, thereby allowing the sample volume to escape the system and be immediately replenished with sea water from the reservior. D.O. of extracted sample was determined by micro-Winkler O_2 titration.

The apparatus connected with the dashed lines indicates the modification of the system for continual D.O. monitoring. The sea water is then transferred through the sealed unit with the D.O. probe. The D.O. probe measures oxygen concentration on the basis of oxygen activity ie. the passage of O_2 molecules across the probe membrane. Therefore, a magnetic stirring apparatus was employed to increase circulation across the membrane.

FIG. 27



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The cores are carefully transferred to insulated water bath containers each containing a Cole-Parmer heater-circulator. The cores were suspended in the water bath by plywood holders with holes drilled the size of the core. A Blue-M refrigeration unit with a cooling coil was used to lower the water temperature in an insulated storage tank to 9°C. This cold water was circulated in variable amounts to the three water baths. Temperature was controlled to ±0.5°C. by this method. Three temperatures were maintained in separate water baths at 10°, ambient and 20°C.

Replicate cores from each area were run at each temperature. The cores were purged with nitrogen just before the cork with the two glass tubes was inserted into the top of the core. The water in each core was pumped at 80 ml/min using three multi-channel Masterflex pump drives with 10 pumps per unit. These peristaltic pumps moved water out of the core to a 3-way valve, and then back into each respective core. The largest number of pumps that can be operated for any one temperature bath is 10. Therefore, 9 cores per bath were set up for oxygen determination using the micro-Winkler, and one core in each bath was used to establish the point when the oxygen level equilibrium is reached using an O_2 probe. One extra "dummy" core, not involved in the pumping system, was used to represent a measure of the sediment and overlying water temperature during the experiment. The cores were equilibrated to the specified temperatures, then monitored for decreases in D.O. concentration for a period of 28 hours. Ten ml were withdrawn maintaining a 100 ml total volume, and 10 ml of a known D.O.

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concentration was added simultaneously to the cores. The 12 ml sample withdrawn was then analyzed using a micro-Winkler technique for D.O. determination (±.08 ppm).

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5.3

To our knowledge the modified experimental design from Christian and Hall (1977), and others, as described above, has not been used before. Therefore, a number of experiments were conducted to critically check the operation of the system.

5.3.1

Circulation rate of the overlying water within the core was checked. Figure 28 shows the design of the core circulation system. The relative length of the glass tubes in the core is important in maintaining rapid circulation rates while not disturbing the core sediments; 370 ml of core was used to test circulation rates. Pontacyl Pink dye was added to the 370 ml of water, fluormetric determinations were taken within 30 sec of dye entrance. After five minutes the dye reached a maximum level in the water column. Thus, at 100 ml/min with a volume of 370 ml, it would take five minutes to completely circulate the water column. The actual cores used for the experiments were adjusted so that they contained 100 ml of water and 6 in. of bay sediment. It took 1.7 min at 80 ml/min to completely circulate the water contents of the core.

5.3.2

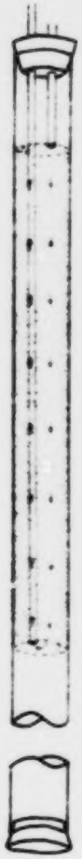
Tests were conducted to determine the effect of hydrogen sulfide resuspension in the cores. Resuspension of the hydrogen sulfide layer in the cores would affect the D.O. levels recorded. Therefore, a test was run where the sediment in the core was slowly agitated so that the reducing layer was introduced into the water column.

FIG. 28

TEST FOR WATER CIRCULATION PATTERN

Dye was introduced into the system to determine circulation patterns. The figure indicates the precise zone of dye concentration in the water column. As evidenced by the drawing, a homogeneous mixture of dye resulted, and did not penetrate the water column above the intake tube or below the exhaust tube.

FIG. 29



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The results of this test is shown in Fig. 29. None of the cores used in the benthal demand experiments were disturbed enough to have any effect of hydrogen sulfide resuspension. Although under natural conditions in the field sediment resuspension does occur.

5.3.3

To test the sensitivity of the apparatus and our D.O. determinations, small fish were respired at different temperatures. The fish were measured and placed in cores with 2 inches of coarse aquarium sand and 300 ml of water. They were allowed to acclimate and then D.O. readings were made over an eight hour period. This experiment was repeated four times using 12 fish at three different temperatures. The results indicate that the system is very sensitive to D.O. changes and the methods used for D.O. determinations are reliable.

5.3.4

Concerning the sources of variation within the experiments, the data show a fairly high variability in the apparent effects of temperature upon uptake rates, as indicated in Figs. 30-31. In order to reduce this variance, a greater number of replicates for each given temperature should be utilized.

An optimum allocation of resources analysis, (OAR), applied in order to elucidate the number of replicates to be used, was performed upon the data for the 28 hours cumulative oxygen uptake rates. This test is designed to identify the greatest source of variation in the experiment, and to predict the experimental design most

FIG. 29

OXIDATION BY SULFIDES OVER TIME

This figure illustrates the effect of resuspension of the bottom sulfide layer or D.O. as measured in Benthal Demand apparatus. The bottom layer was agitated during the following time intervals: 0 to 7 min.; 10-12 min.; and 16-17 min.

FIG. 29

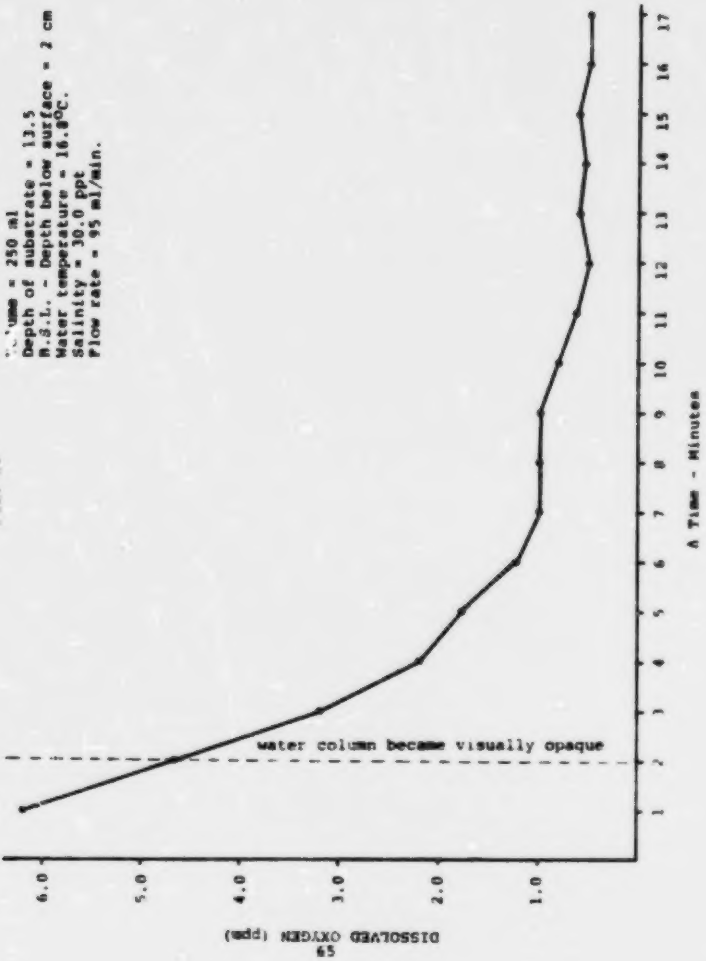


FIG. 30

Standard Error Of Mean O_2 Uptake

For 28 Hour Cumulative Rates As A Function of Temperature

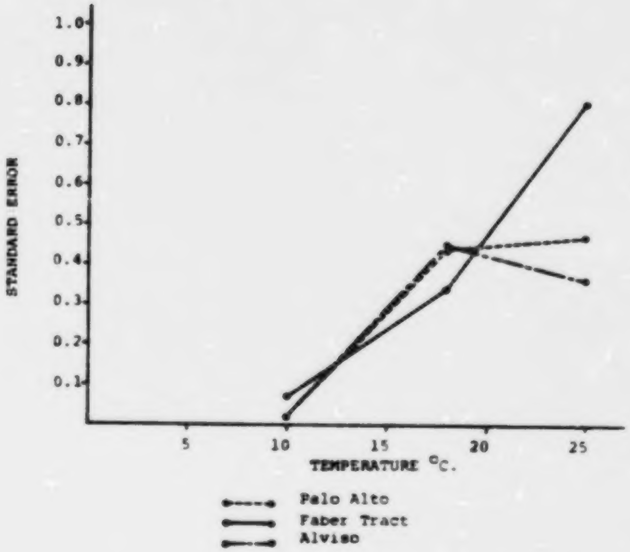
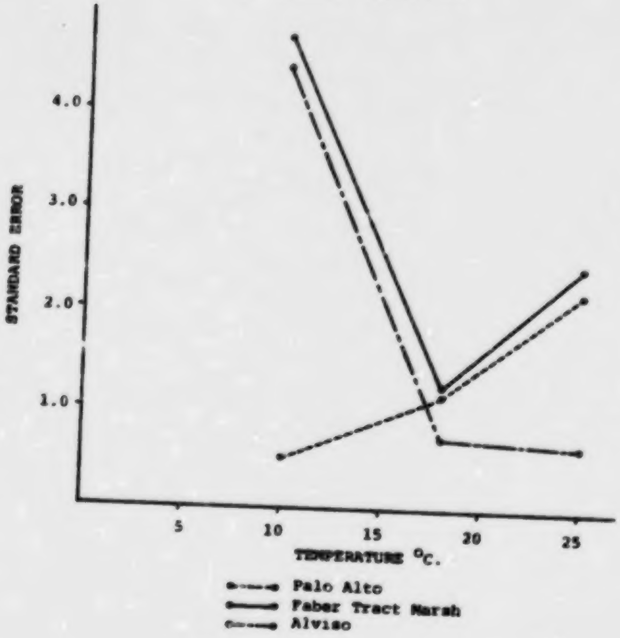


FIG. 31

Standard Error of Mean O_2 Uptake For Maximum Rates Between Determinations As A Function of Temperature



PRELIMINARY

sensitive to the greatest source of variation. A two-way Model I ANOVA with replication, using a square root transformation (as the variance is heteroscedastic), was employed to calculate the required mean square values for the OAR. This analysis shows that the greatest source of variation was within cores, per temperature, per area, and the least source of variation was between areas. If three different areas are to be examined, and 18 cores are to be utilized, then, for each area 3 temperatures with 6 replicates per temperature is the suggested optimal experimental design indicated by the OAR.

It is clearly evident that both the examination of variance through the standard error calculations, and the OAR results, that replication of cores per temperature is essential to adequately examine the differences between areas and/or temperature for measurements of O_2 uptake. The level of accuracy will depend on the number of replicate core samples taken.

5.3.5

These experiments indicate that the methods developed for the benthal demand data analysis seem to be adequate. The system reduces some of the problems of past laboratory approaches, but still presents the problem of not being "in situ". However, the "in situ" apparatus introduce problems which are not present in our laboratory apparatus.

PRELIMINARY

At the conclusion of the 28 hour benthal demand runs, the core sediment was sieved through a 1.0, and 0.5 mm, and .275 mm screens to remove the animals. The invertebrates were counted, identified, and preserved. After the 28 hours, at all temperatures, the infaunal animals were alive and active. The animals in the 10°C. sediment were least active, as one would expect. No attempt was made to divide the biological oxygen demand from the chemical demand.

PRELIMINARY

5.4 DISCUSSION

In the report by Hydroscience, Inc. of the reverification analysis of the San Francisco Bay Water Quality model the Benthal Demand measurements made by E. H. Smith & Associates was viewed as questionable. No explaination of the statement was presented in the report. The estimated value established by Hydroscience, Inc. in the 1967 field survey was used. Mr. Szumski of Hydroscience, Inc. was contacted to find out how their values were obtained. We were informed that the orginal report was not readily available and that the results were obtained by the use of a Warburg apparatus. Our experience with Warburg apparatus dates back to 1960 when this apparatus was used extensively to obtain D.O. consumption rates of whole animals or their parts. This apparatus has since been shown to give unrealiable results, and is now not used. No indication was given as to how the results were obtained, at what temperatures, or weather the sediment had been analyzed for infaunal animals. Therefore, it is difficult to judge the validity of the values used by Hydroscience, Inc.

A recent article by Pamatmat (1977) reviews benthic community metabolism. He states that a single holistic method for measuring soft bottom community metabolism has not been developed. The accuracy of estimating "in situ" rates still raise questions about "in situ" versus laboratory measurements (Edberg and Hofsten 1973), stirring versus no stirring, flow-through versus stirred enclosures.

PRELIMINARY

Laboratory samples are usually sediment cores. Oxygen uptake of sediment cores has been measured aboard ship (Pamatmat, 1971a), and if taken carefully, the oxygen uptake of sediment cores at "in situ" temperature is the same as rates measured "in situ", at least to 23 m depth (Pamatmat, 1971). Contrary to these findings James, 1974, found that sediment cores tend to respire less than sediment enclosed "in situ". The D.O. values obtained in our benthal demand studies are similar to those recorded by Pamatmat and James (1973) for stations in the Puget Sound. They found values ranging from 3.6 to 26.5 ml O_2 m^{-2} hr^{-1}. Variation in their data is also similar to the results obtained in South Bay. Temperature is a major factor in the variation and must be taken into account in any analysis.

It should be pointed out that present estimates of benthic oxygen consumption are based on measurements from undisturbed sediments, while in nature sediments are disturbed periodically by tidal currents, and aperiodically by burrowing organisms or by wind and wave generated turbulence. None of these factors were tested in our experiments. It was noted that at rapid water exchange periods in the sloughs there was some resuspension of bottom sediments which could reduce D.O. near the bottom. The core method employed in this study did exchange water, but did not cause turbidity so that natural conditions were not obtained.

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PRELIMINARY

We were scheduled to analyze 30 "in situ" bottom demand samples taking only one core in each location. In testing our procedure after the first benthal demand experiment we found that 6 replicates should be collected for each temperature. It was also noted that from the three locations sampled, it was more meaningful to increase replicates rather than take more stations in different areas. Although these results were based upon only three areas, our eariler study of the South Bay regime has shown that the sediment size distribution is fairly uniform. It would be best to take six replicates in six or eight locations to check these preliminary observations. However, due to time and budget constraints it was felt that more accurate data could be obtained by using replicates in only three areas, rather than single cores in 30 areas. More samples should be made throughout the year to investigate summer field conditions, since temperature is a major factor in O_2 consumption rates. The field temperature of the sediments during the benthal demand experiments ranged from 16° to 10°C. while summer temperatures can reach 25°C. Increasing or decreasing sediment temperature in laboratory experiments may introduce artifacts. Therefore, it would be better to conduct the experiment at the "in situ" temperatures during the year.

Bearing in mind the variation between cores and between temperatures it is difficult to understand how a single value of 0.1 gm O_2 m^{-2} day^{-1} could be developed by Hydroscience, Inc. from our data. This range of variation is commonly reported in the literature, and our results show it to occur in at least three locations in South Bay.

PRELIMINARY

Since seasonal temperature ranges are large in South Bay, it would be difficult to establish a single figure to fit all seasons. Hydroscience, Inc. does not explain what data set or sets were used from our results, nor how the single value was developed. This value is compared to one established in 1967 by, at present, unknown methods and determined to be low. Our results certainly fall within published value ranges. Analysis of the cores (Appendix III) show small numbers of small animals. The presence of fauna in the sediments must be taken into consideration, and may explain some of the variation between cores and between sites. Smith (1974) found the meiofaunal - microfaunal - microfloral respiration contributed from 25% to 58% of total community respiration in a sublittoral community off Sapelo Island, Georgia. Therefore, it is impossible to compare our values with those of Hydroscience, Inc. since we do not have any information on how their values were established.

PRELIMINARY

REFERENCES

Christian, R. R. & J.R. Hall 1977 Experimental trends in sediment microbial hererotrophy: radioisotopic techniques and analysis. In *Ecology of Marine Benthos*, ed. by Bruce Coull. University of South Caroline Press.

Edberg, N. & B. V. Hofstern 1973 Oxygen uptake of bottom sediments studied "in situ" and in the laboratory. Water Res. *7*: 1285-1294.

James, A 1974 The measurement of benthal respiration, Water Res. *8*: 955-959.

Pamatmat, M. M. 1971 *a* Oxygen consumption by the seabed IV shipboard and laboratory experiments. Limnol, Oceanogr. *16*: 536-550.

____________________ *b* Oxygen consumption by the seabed. VI, seasonal cycle of chemical oxidation and respiration in Puget Sound, Int. Revue. ges, Hydrobiol, *56*: 769-793.

Pamatmat, M. M. & R. S. Jones 1973 Oxidation of organic matter in sediment, Ecological Research Series, E.P.A. 660/3-73-005.

Pamatmat, M. M. 1977 Benthic community metabolism; a review and assessment of present status and outlook. In *Ecology of Marine Benthos*, ed. by Bruce C. Coull.

PRELIMINARY

REFERENCES

(Continued)

Smith, K. L. Jr. 1974 Oxygen demands of San Diego trough sediments: an "in situ" study Limnol. Oceanogr. 19: 939-944.

Smith, K. L.; G. T. Rowe; and C. H. Clifford 1974 Sediment oxygen demand in an outwelling and upwelling area Tethys. 6: 223-229.

APPENDIX I

SLOUGH HYDROLOGY DATA

SLOUGHS-HYDROLOGICAL DATA

Date of Collection 8/24/77

Mowrey Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	4.0	44	50	55	.91	115.5	105.1	Incoming
1100	5.[illegible]	51	50	130	.38	186.0	71.5	Outgoing
1300	2.5	34	50	70	.71	56.5	40.4	Outgoing
1500	1.5	26	50	75	.67	26.5	17.8	Outgoing
1700	1.0	18	50	130	.38	13.5	5.13	Incoming
1900	4.0	45	50	70	.71	115.5	82.0	Incoming

Newark Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0920	5.5	114	30	96	.32	342.0	109.8	Incoming
1120	6.5	120	30	162	.19	462.0	87.8	Outgoing
1320	4.5	104	30	76	.39	231.0	91.2	Outgoing
1520	2.0	52	30	130	.23	49.5	11.4	Outgoing
1720	2.5	60	30	58	.52	72.5	37.5	Incoming
1920	5.5	115	30	50	.60	342.0	205.2	Incoming

SLOUGHS-HYDROLOGICAL DATA

Date of Collection 8/24/77

Faber Tract Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	7.5	71	30	90	.33	319.0	106.33	Incoming
1000	8.5	73	15	40	.38	390.5	146.4	Incoming
1100	9.0	75	30	107	.28	429.0	120.3	Outgoing
1200	7.0	67	15	100	.15	289.5	43.4	Outgoing
1300	5.5	62	15	60	.25	189.5	47.4	Outgoing
1400	5.25	59	15	60	.25	180.8	45.2	Outgoing
1500	5.0	57	15	100	.15	159.5	24.0	Outgoing
1600	4.5	53	15	57	.26	129.5	34.0	Incoming
1700	5.0	57	15	30	.50	159.5	78.0	Incoming
1800	7.0	67	15	20	.75	289.5	217.0	Incoming
1900	9.5	75	15	28	.54	464.0	251.0	Incoming

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SLOUGHS-HYDROLOGICAL DATA

Newark Slough

Date of Collection: 9/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
1030	2.5	32	20	20	1	43.5	44	Incoming
1200	4.5	84	30	35	.86	170.5	147	Incoming
1400	7.5	122	30	50	.60	502	301	Incoming
1600	7.0	120	30	65	.46	441	203	Outgoing
1800	3.5	60	30	41	.73	95	70	Outgoing
2000	2.0	21	30	39	.77	23	18	Outgoing

Mowry Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
1000	1.5	28	50	105	.48	23	11.04	Incoming
1200	4.5	48	50	40	1.25	135.5	169.4	Incoming
1400	8.5	65	50	150	.33	353.5	116.7	Incoming
1600	7.5	59	50	40	1.25	291.0	363.8	Outgoing
1800	5.0	48	50	60	.83	159.0	132	Outgoing
2000	2.5	34	50	65	.77	55.0	42.3	Outgoing

E.N. Smith & Assocaites

SLOUGHS-HYDROLOGICAL DATA

Faber Tract Slough

Date of Collection: 9/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Rate cfs.	Tide
1000	2.5	13	16	20	.8	17	14	Incoming
1100	4.5	40	16	14	1.14	51	58	Incoming
1200	5.5	60	15	13	1.23	125	154	Incoming
1300	8.0	70	32	15	2.13	285	607	Incoming
1400	10.0	78	32	34	.94	427	401	Incoming
1500	10.0	78	32	32	1.0	427	427	Outgoing
1600	8.0	70	32	16	2.0	285	570	Outgoing
1700	6.5	65	32	38	.84	194	163	Outgoing
1800	4.5	40	32	52	.62	51	32	Outgoing
1900	3.0	18	16	30	.53	24.5	13	Outgoing
2000	2.5	13	16	60	.27	17	5	Outgoing

SLOUGHS-HYDROLOGICAL DATA

Mowry Slough

Date of Collection: 10/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	1.5	25	50	40	1.25	25	31	Outgoing
1100	3.5	35	50	50	1.0	87	87	Incoming
1300	7.5	56	50	6.	.83	267	223	Incoming
1500	9.0	>70	50	120	.42	354	149	Incoming
1700	6.0	52	50	41	1.2	195	237	Outgoing
1900	3.5	35	50	65	.77	87	67	Outgoing

Newark Slough

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0900	1.5	21	30	34	.88	20	18	Incoming
1100	5.5	110	30	22	1.36	279	380	Incoming
1300	8.0	>120	30	38	.79	570	457	Incoming
1500	9.0	120	30	36	.83	687	573	Outgoing
1700	6.0	115	30	17	1.76	336	591	Outgoing
1900	3.5	62	30	42	.71	106	75	Outgoing

SLOUGHS-HYDROLOGICAL DATA

Faber Tract Slough

Date of Collection: 10/14/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0830	1.8	10	10	120	0.08	12.6	<5	Outgoing
0915	2.0	12	10	63	0.16	16.0	<5	Incoming
1000	3.0	21	10	15	0.66	33.0	22	Incoming
1100	5.0	60	10	8	1.25	128.5	161	Incoming
1200	7.5	65	10	6.5	1.50	223.5	344	Incoming
1300	9.5	72	10	7	1.40	437	624	Incoming
1400	10.0	78	20	22	0.91	473	430	Incoming
1500	9.5	72	10	7	1.40	437	626	Outgoing
1600	8.5	70	20	8	2.50	336	840	Outgoing
1700	5.5	63	20	11	1.80	105	187	Outgoing
1800	3.5	31	10	12	0.80	50	42	Outgoing
1900	3.0	21	10	15	0.50	33	16.5	Outgoing

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SLOUGH HYDROLOGY

Henry

Date of Collection: 11/16/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	5.5	51	50	60	.83	178	154	Outgoing
1000	3.5	35	50	73	.69	87	60	Outgoing
1200	2.5	36	50	93	.54	55	30	Incoming
1400	5.5	51	50	60	.83	186	154	Incoming
1600	8.0	63	50	129	.39	303	118	Incoming
1730	7.5	59	50	105	.48	267	128	Outgoing

[illegible]

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	4.5	104	25	135	.18	231	42	Outgoing
1000	3.5	62	25	38	.66	106	70	Outgoing
1200	3.0	60	25	30	.83	89	74	Incoming
1400	5.5	112	25	25	1.0	280	280	Incoming
1600	7.5	>120	25	125	.2	537	107	Incoming
1800	7.0	>120	25	60	.42	499	208	Outgoing

SLOUGH HYDROLOGY

Faber Tract

Date of Collection: 11/16/77

Time	Depth ft.	Width ft.	Transect Length ft.	Flow Time sec.	Velocity fps.	Cross Sectional Area ft.^{2}	Flow Rate cfs.	Tide
0800	5.5	62	20	37	.54	140	75	Outgoing
0900	5.0	60	10	22	.45	110	50	Outgoing
1000	3.0	20	10	29	.34	33	11	Outgoing
1100	2.5	16	10	120	.10	24	<5	Slack
1200	4.0	41	20	30	.66	70	47	Incoming
1300	5.0	60	20	25	.80	110	88	Incoming
1400	6.5	65	20	25	.80	194	155	Incoming
1500	7.5	65	20	15	1.33	260	346	Incoming
1600	8.5	70	20	37	.54	328	177	Incoming
1700	8.0	70	20	18	1.1	293	322	Outgoing
1730	6.5	65	20	15	1.33	194	258	Outgoing

APPENDIX II

FILTRABLE and NON-FILTRABLE RESIDUE DETERMINATIONS FOR SLOUGHS

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Non* Filtrable Residue mg/1	Filtrable* Residue mg/1	Total* Ortho-PO$_4$ mg/1
824Mo1	0900	3431	60	37,100	1.1
824Mo2	1100	3429	93	35.300	1.1
824Mo3	1300	3432	96	34,700	1.0
824Mo4	1500	3453	121	30,200	0.77
824Mo5	1700	3427	62	24,300	0.70
824Mo6	1900	3430	57	33,900	0.93

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non* Filtrable Residue mg/1	Filtrable* Residue mg/1	Total* Ortho-PO$_4$ mg/1
824Ne1	0900	3416	72	41,700	2.2
824Ne2	1100	3426	110	40,000	2.1
824Ne3	1300	3428	130	43,000	2.1
824Ne4	1500	3425	270	40,700	2.5
824Ne5	1700	3424	130	40,500	2.4
824Ne6	1900	3415	100	28,000	2.2

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DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection 8/24/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/1	Filtrable* Residue mg/1	Total* Ortho-PO_4 mg/1
824Pt1	0900	3414	10	37,100	1.2
824Pt2	1000	3411	230	35,400	1.1
824Pt3	1100	3405	150	36,300	1.1
824Pt4	1200	3413	120	40,400	1.2
824Pt5	1300	3417	150	40,500	1.3
824Pt6	1400	3412	82	39,400	1.3
824Pt7	1500	3418	112	35,000	1.4
824Pt8	1600	3420	110	40,000	1.4
824Pt9	1700	3419	310	41,000	1.2
824Pt10	1800	3410	350	36,600	1.1
824Pt11	1900	3421	110	40,500	1.1

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DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/1	Total* Filtrable Residue mg/1	Total * Ortho PO_4 mg/1	Nitrite * mg/1	Chloro-* phyll-a mg/m^3
914Mo-1	1000	3604	550	22,020	0.54	0.033	1.4
914Mo-2	1200	3605	470	25,700	0.43	0.094	9.0
914Mo-3	1400	3609	364	36,300	1.0	0.078	3.9
914Mo-4	1600	3602	267	34,100	0.95	0.114	5.2
914Mo-5	1800	3603	266	31,580	0.70	0.12	L.A.
914Mo-6	2000	3610	141	25,600	0.80	0.045	9.0

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/1	Total* Filtrable Residue mg/1	Total * Ortho PO_4 mg/1	Nitrite * mg/1	Chloro-* phyll-a mg/m^3
914Ne-1	1030	3617	120	39,200	2.1	0.119	15
914Ne-2	1200	3619	150	33,700	1.8	0.161	-
914Ne-3	1400	3622-A	28	33,800	2.1	0.060	0.5
914Ne-4	1600	3621	356	35,500	1.6	0.20	4.5
914Ne-5	1800	3620	35.6	37,600	1.8	0.13	1.5
914Ne-6	2000	3618	303	37,600	2.0	0.092	9.5

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DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 9/14/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
914Ft-1	1000	3623	102	34,900	0.81	0.082	9.1
914Ft-2	1100	3615	110	26,000	0.82	0.089	2.0
914Ft-3	1200	3622	28	33,800	2.1	0.060	<0.5
914Ft-4	1300	3608	98	35,000	0.54	0.041	2.9
914Ft-5	1400	3607	249	34,500	0.43	0.029	L.A.
914Ft-6	1500	3614	296	35,000	0.40	0.029	1.1
914Ft-7	1600	3611	32.0	34,600	0.54	0.05	3.8
914Ft-8	1700	3606	21.3	34,800	0.55	<0.002	1.9
914Ft-9	1800	3613	106	36,560	0.58	0.061	2.2
914Ft-10	1900	3612	300	33,700	0.54	0.062	11
914Ft-11	2000	3616	82	35,400	0.54	0.059	2.8

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DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 10/13/77

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1014Mo-1	0900	3961	433	21,600	1.0	0.031	0.6
1014Mo-2	1100	3970	216	30,220	0.52	0.048	1.7
1014Mo-3	1300	3967	360	31,400	1.2	0.038	14
1014Mo-4	1500	3972	194	32,500	0.90	0.047	0.2
1014Mo-5	1700	3966	270	30,300	1.1	0.042	0.2
1014Mo-6	1900	3969	292	27,300	0.86	0.056	1.0

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro-* phyll-a mg/m^3
1014Ne-1	0900	3958	314	36,300	2.5	0.099	4.8
1014Ne-2	1100	3950	362	31,200	2.0	0.093	0.7
1014Ne-3	1300	3963	85	31,700	1.9	0.17	3.7
1014Ne-4	1500	3960	83	34,800	1.5	0.12	2.1
1014Ne-5	1700	3962	83	34,400	2.1	0.11	3.0
1014Ne-6	1900	3955	466	32,400	2.3	0.089	56

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DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection:

Sample #	Time of Collection	Laboratory Descriptor	Non-* Filtrable Residue mg/l	Total* Filtrable Residue mg/l	Total* Ortho PO_4 mg/l	Nitrite* mg/l	Chloro-* phyll-a mg/m^3
1014Ft-1	0830	3940	242	33,400	0.94	0.068	0.8
1014Ft-2	0915	3942	162	33,600	1.1	0.081	8.0
1014Ft-3	1000	3943	134	32,000	1.2	0.060	3.0
1014Ft-4	1100	3944	89	35,000	1.0	0.081	0.6
1014Ft-5	1200	3946	67	31,700	1.1	0.050	0.9
1014Ft-6	1300	3941	99	34,600	1.1	0.044	0.8
1014Ft-7							
1014Ft-8	1500	3986	96	34,800	0.95	0.048	4.8
1014Ft-9	1600	3987	111	34,300	0.95	0.053	0.74
1014Ft-10	1730	3984	164	32,000	0.92	0.064	0.8
1014Ft-11	1800	3982	152	33,600	1.1	0.066	0.2
014Ft-12	1900	3985	152	33,800	1.0	0.063	0.4

*Assay performed by Pacific Marine Station Water Quality Laboratory

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E.H. Smith & Associates

DIFFUSE SOURCE LOAD EVALUATION

Mowry Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro- * phyll-a mg/m^3
1116Mo-1	0800	4123	230	30,400	1.3	0.11	2.4
111GMo-2	1000	4121	240	23,700	1.2	0.13	1.5
1116Mo-3	1200	4134	120	18,200	0.36	0.12	4.8
1116Mo-4	1400	4126	300	29,000	0.,3	0.14	5.0
1116Mo-5	1600	4122	260	31,900	1.2	0.14	1.3
1126Mo-6	1,30	4120	150	31,800	1.4	0.19	2.3

Newark Slough

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/l	Total * Filtrable Residue mg/l	Total * Ortho PO_4 mg/l	Nitrite * mg/l	Chloro- * phyll-a mg/m^3
1116Ne-1	0800	4130	80	31,100	2.0	0.29	5.5
1116Ne-2	1000	4125	140	32,900	1.9	0.21	6.6
1116Ne-3	1200	4129	340	32,400	2.0	0.23	11
1116Ne-4	1400	4128	190	30,500	2.0	0.32	5.7
1116Ne-5	1600	4125	1000	30,100	2.0	0.29	1.8
1116Ne-6	1745	4131	94	31,700	1.3	0.32	L.A.

DIFFUSE SOURCE LOAD EVALUATION

Faber Tract Slough

Date of Collection: 11/16/77

Sample #	Time of Collection	Laboratory Descriptor	Non- * Filtrable Residue mg/1	Total * Filtrable Residue mg/1	Total * Ortho PO_4 mg/1	Nitrite * mg/1	Chloro-* phyll-a mg/m^3
1116Ft-1	0800	4133	110	33,300	1.2	0.17	4.1
1116Ft-2	0900	4137	110	32,300	1.2	0.17	3.0
1116Ft-3	1000	4136	120	32,640	0.98	0.17	3.6
1116Ft-4	1100	4135	120	32,700	1.1	0.13	3.3
1116Ft-5	1200	4139	130	32,400	1.2	0.18	3.2
1116Ft-6	1300	4141	120	33,000	1.3	0.17	4.2
1116Ft-7	1400	4138	100	33,400	1.2	0.18	6.0
1116Ft-8	1500	4142	92	33,900	1.0	0.13	3.7
1116Ft-9	1600	4140	110	33,100	1.0	0.17	2.1
1116Ft-10	1700	4132	78	33,400	1.1	0.16	2.0
1116Ft-11	1730	4127	110	32,700	1.2	0.14	2.1

* Assay performed by Pacific Marine Station Water Quality Laboratory

APPENDIX III

BENTHAL DEMAND ANALYSIS DATA

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BENTHAL DEMAND

Rates of O_2 Uptake

I. Cumulative Rates

ml $O_2/m^2/h$

	Temp. C°:	10		
	Δt:	4h	22h	28h/Total
	Date:	12/29	12/29-30	12/29-30
Sample #	Time Interval:	1115-1515	1115-0915	1115-1515
FT-10 A		1.57	5.13	6.89
FT-10 B		1.88	7.06	7.03
PA-10 A		0.0	4.22	5.19
PA-10 B		0.0	2.73	5.24
Al-10A		3.76	4.84	5.24
Al-10B		3.44	2.45	5.28

	Temp. C°:	18		
	Δt:	4h	22h	28h
	Date:	12/29	12/29-30	12/29-30
Sample #	Time Interval:	1115-1515	1115-0915	1115-1515
FT-18A		N.S.[1]	3.69	4.44
FT-18B			3.76	5.12
PA-18A			6.33	6.37
PA-18B			6.61	7.15
Al-18A			6.54	4.96
Al-18B			3.90	4.07

[1]. NOT SAMPLED

BENTHAL DEMAND

Rates of O_2 Uptake

I. Cummulative Rates

ml $O_2/m^2/h$

	Temp. C°:	25		
	Δt:	4h	22h	28h
	Date:	12/28	12/28-29	12/28-29
Sample #	Time Interval:	1115-1515	1115-0930	1115-1530
FT-25A		22.56	8.37	6.58
FT-25B		17.54	6.32	4.96
PA-25A		26.00	7.24	7.16
PA-25B		21.60	6.95	6.31
Al-25A		23.81	7.46	6.84
Al-25B		25.07	9.63	7.56

BENTHAL DEMAND

Rates of O_2 Uptake

II. Rates Between O_2 Determinations

	Temp. C°:	10		
	Δt:	4h	18h	6h
	Date:	12/29	12/29-30	12/30
Sample #	Time Interval:	1115-1515	1515-0930	0930-1530
FT-10A		1.57	5.91	13.36
FT-10B		1.88	8.21	6.89
PA-10A		0.0	5.15	8.77
PA-10B		0.0	3.34	9.81
Al-10A		3.76	5.08	6.68
Al-10B		3.44	2.23	15.66

	Temp. C°:		18	
	Δt:		18h	6h
	Date:		12/29-30	12/30
Sample #	Time Interval:		1515-0930	0930-1515
FT-18A		N.S.[1]	3.69	6.68
FT-18B			3.76	9.19
PA-18A			6.33	6.47
PA-18B			6.61	8.77
Al-18A			6.54	6.02
Al-18B			5.43	4.59

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[1] NOT SAMPLED

BENTHAL DEMAND

Rates of O_2 Uptake

II. Rates Between O_2 Determinations

ml $O_2/m^2/h$

	Temp. C°:	25		
	Δt:	4h	18h	6h
	Date:	12/29	12/29-30	12/30
Sample #	Time Interval:	1115-1515	1515-0915	0945-1515
FT-25A		22.56	5.22	0.0
FT-25B		17.54	3.83	0.0
PA-25A		26.00	3.01	6.89
PA-25B		21.60	3.69	3.96
Al-25A		23.81	3.13	4.59
Al-25B		25.07	5.43	2.29

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E.H. Smith & Associate.

BENTHAL DEMAND

Mean Rates of O_2 Uptake
I. Cumulative Rates
ml $O_2/m^2/h$

Sample#													
	Temp. C°	10											
	Δt:	4h				22h				28h/Total			
	Date:	12/29				12/29-30				12/29-30			
	Time Interval:	1115-1515				1115-0915				1115-1515			
		$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n
FT10		1.72	.05	.219	2	6.09	1.86	1.36	2	6.96	0.01	0.10	2
PA 10		0.00	-	-	2	3.47	1.11	1.36	2	5.21	.001	.035	2
AL10		3.60	.05	.226	2	3.64	2.85	1.69	2	5.26	.001	.028	2
	Temp. C°	18											
FT18		Not Sampled				3.72	.002	0.05	2	4.78	0.23	0.48	2
PA18		"	"			6.47	0 04	.197	2	6.76	0.30	0.55	2
AL18		"	"			5.22	3.48	1.86	2	4.51	0.40	0.63	2
	Temp. C°	25											
FT25		20.1	12.6	3.5	2	7.34	2.10	1.45	2	5.77	1.30	1.14	2
PA25		23.8	9.70	3.11	2	7.09	0.04	0.21	2	6.73	0.36	0.60	2
AL25		24.4	0.79	0.89	2	8.54	2.30	1.50	2	7.20	0.26	0.51	2

E.H. Smith & Associates

BENTHAL DEMAND

Mean Rates of O_2 Uptake
II. Rates Between Determinations
ml $O_2/m^2/h$

Sample #													
	Temp. C°:	10											
	Δt:	4h				18h				6h			
	Date:	12/29				12/29-30				12/29-30			
	Time Interval:	1115-1515				1115-0915				1115-1515			
		$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n	$\bar{x}$	s^2	s	n
FT10		As for 10° Cumulative Rates				7.06	2.64	1.62	2	8.62	44.8	6.69	2
PA10						4.25	1.60	1.29	2	9.29	0.54	0.73	2
AL10						3.65	4.10	2.00	2	11.17	40.0	6.30	2
	Temp. C°	18											
FT18		Not Sampled				3.72	.002	0.05	2	7.93	3.15	1.77	2
PA18						6.47	0.04	0.19	2	7.62	2.65	1.62	2
AL18						5.98	0.62	0.78	2	5.30	1.02	1.01	2
	Temp. C°	25											
FT25		As for 25° Cumulative Rates				4.25	0.96	0.98	2	0.00	-	-	2
PA25						3.35	0.23	0.48	2	5.42	4.30	2.07	2
AL25						4.28	2.60	1.62	2	3.44	2.65	1.62	2

BENTHAL DEMAND

CHEMICAL PARAMETERS

Date of Collection: 12/28/77

Overlying Water

Sample #	Laboratory Descriptor	Ammonia* Nitrogen mg/l	Temp. C°	Total* Sulfides mg/l	T.O.C.* mg/l	Total* Volatile Solids mg/g	p.H	Salinity ppt	D.O. mg/l
1228FT-W	4357	1.4	12	0.19	5.1	-	7.5	27.5	4.8
1228PA-W	4355	1.3	15	0.10	12	-	7.6	28.0	7.2
1228A1-W	4356	3.0	14.0	0.05	100	-	7.4	27.5	3.4

Sediments

Sample #	Laboratory Descriptor	Ammonia* Nitrogen mg//kg	Temp. C°	Total Volatile* Solids mg/g	p.H.
1228FT-S	4377	4.7	12	24	6.9
1228PA-S	4376	4.1	13	30	6.8
1228A1-S	4375	10	12	39	6.9

* Assay performed by Pacific Marine Station Water Quality Laboratory

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BENTHAL DEMAND

Biochemical Oxygen Demand

Date of Collection: 12/28/77

Sample #	Laboratory Descriptor	Immediate	Sampling Interval (Days) 1	3	5	7
1228FT-S	4375	1.1	2.5	2.7	17	31
1228PA-S	4376	2.4	2.7	4.1	5.0	6.0
1228A1-S	4377	0.3	1.0	1.3	1.8	2.1

Sediment Analysis

Sample #	Total Wt.	Phi Units: Microns:	0.737 6.00	1.234 425	2.000 250	2.474 180	3.000 125	3.737 75	3.989 63	4.7818 38	4.718 38
1228FT-S	54.71		13.49	1.84	5.62	2.27	1.2	2.32	0.37	1.5	26.1
1228PA-S	50.61		0.2	0.1	0.06	0.17	0.24	0.67	0.6	0.42	48.9
1228A1-S	58.4		0.82	0.0	0.01	0.0	0.09	0.67	0.0	1.42	55.41

Percent Weight

1228FT-S	-		24.60	3.63	10.27	4.15	2.19	4.24	0.67	2.74	47.7
1228PA-S	-		0.39	0.19	0.12	0.34	0.47	1.34	1.19	0.83	96.11
1228A1-S	-		1.40	0	0.17	0	0.15	1.15	0	2.43	94.88

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BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Faber Tract Marsh

Temperature	10°		18°		25°	
Core Number	FT10A	FT10B	FT18A	FT18B	FT25A	FT25B*
SPECIES						
Polychaeta						
Tharynx parvus	2	4	-	-	1	
Neanthes succinea	2	1	-	-	2	
Peloscolex gabriellae	21	27	35	45	52	
Polydora sp.	-	-	1	1	-	
Streblospio benedicti	3	5	10	13	5	
Arthropoda						
Corophium sp.	-	1	1	-	1	
Gnorimosphaeroma sp.	-	1	3	-	-	
Mollusca						
Nassarius obsoletus	1	-	-	-	-	

* Fauna not enumerated

BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Palo Alto Harbor

Temperature	10°		18°		25°	
Core Number	PA10A	PA10B	PA18A	PA18B	PA25A	PA25B*
SPECIES						
Polychaeta						
Tharynx parvus	2	14	9	1	18	
Neanthes succinea	1	-	5	-	1	
Peloscolex gabriellae	14	62	96	18	32	
Polydora sp.	-	-	-	-	1	
Streblospio benedicti	31	19	31	12	26	
Arthropoda						
Corophium sp.	5	1	3	3	4	
Mollusca						
Nassarius obsoletus	-	-	-	1	-	

* Fauna not enumerated

BENTHAL DEMAND

Faunal Abundances per Core
12/28-29/77

Alviso Harbor

Temperature	10°		18°		25°	
Core Number	AL10A	AL10B	AL18A	AL18B	AL25A	AL25B *
SPECIES						
Polychaeta						
Eteone californica	-	-	2	1	-	
Neanthes succinea	-	-	1	-	-	
Peloscolex gabriellae	68	58	88	43	40	
Polydora sp.	-	-	-	-	3	
Streblospio benedicti	-	1	35	9	14	
Arthropoda						
Corophium sp.	4	6	9	1	14	

* Fauna not enumerated

Appendix I

TERRESTRIAL AND WETLANDS BIOLOGICAL SURVEY, 1975

TERRESTRIAL BIOLOGY FIELD NOTES-SOUTH BAY PROJECT

As a part of a qualitative baseline survey of the South Bay Dischargers pipeline corridors and potentially affected surrounding areas, Bechtel biologists have examined all or part of the route on five occasions in the last 5 months. Dates of site visits include July 22, August 14, October 2, October 21, and November 3, 1975. There were several purposes for these site surveys:

1. to determine those specific localities in the project area having the highest biological significance, in terms of overall variety and numbers of species present

2. to determine where possible, using the walk-through survey technique, the presence of any rare, treatened, or endangered species and species of special interest or concern to local conservation or regulatory entities

3. to determine if the status of wildlife or wildlife habitats in specific localities has changed since field and literature surveys were made for the programmatic environmental report on the pipeline.

The presentation of field survey reports which follows is arranged by location (nearest Station number) and date. A report on trapping surveys for the salt marsh harvest mouse along the pipeline route follows the dated field survey reports.

Artesian Slough (Near Station 1)
July 22, 1975

The Artesian Slough, the discharge channel for the San Jose sewage treatment plant, is located inside the border of the San Francisco Bay National Wildlife Refuge. The channel is lined through most of its course to Coyote Creek by dense stands of bulrushes and cattails. The heaviest concentrations of birds were observed in the mudflat and tule island area between the Leslie Salt Company ponds A-16 and 1-18. Snowy egrets were observed nesting in the crowns of the bulrushes (two nests with two large chicks in each were observed). Ring-billed gulls were abundant as were black-crowned night herons (roosting in the bulrushes), western sandpipers, snowy egrets, and black-necked stilts. The concentration and variety of birds in this area was spectacular [illegible] similar to the Guadalupe Slough near the Sunnyvale treatment plant.

Salt pond A-18 to the east had between 50 to 75 Wilson's Phalaropes out in its center. A long-billed curlew and a willet were also seen. Brine shrimp were abundant.

August 14, 1975

We took a series of slides of the nesting snowy egrets and confirmed the presence of at least one pair of chicks. We counted 84 snowy egrets roosting in, or standing near, the two large clumps of bulrushes where nesting had apparently occurred. It is not possible to determine the total number of nests which were attempted because of our appearance on the site at the very end of the nesting season.

October 2, 1975

The shoveler was the main species in markedly increased abundance. The large roosting flock of snowy egrets was not present and only two birds were observed in the large bulrush islands. Both of these birds showed signs of down on the heads but were otherwise plumed as adults.

Neither U.S. Fish and Wildlife Service biologists nor California Fish and Game biologist have confirmed that snowy egrets nested at Artesian this season. We learned that brine shrimp are harvested commercially from salt pond A18 east of Artesian Slough. Due to a very high tide level, few wading birds were observed in the area.

During the last few weeks, the Fish and Wildlife Service and California Fish and Game have been investigating an outbreak of botulism in the South Bay. The highest mortality has been noted in Artesian Slough and nearby areas in Coyote Creek and Mud Slough. Shovelers have been severely affected.

Alviso Slough/Guadalupe River (Station 5)
July 22, 1975

The crossing at Alviso Slough is an area with scattered patches of tules which could probably support wildlife if the stream were not channelized. Four or five black-necked stilts were foraging in the mudflats. This level of bird use is very light compared to the Artesian Slough area.

Alviso Slat Marsh (Station 7)
October 2, 1975

We examined the Alviso marsh with Ms. Cathy Osugi, biologist with the U.S. Fish and Wildlife Service. She informed us that the rodent signs which were so abundant could be from the house mice entering the area from the adjacent landfill. (See the end of this Appendix for the results of Ms. Osugi's trapping survey.) A white tailed kite was foraging over the marsh and was later observed diving on a passing Swainson's hawk.

November 3, 1975

The Alviso salt marsh was heavily flooded; the section on the east side of the road was dry, however. It became apparent that the pickleweed field west of Saratoga Creek is a portion of the old Alviso salt marsh.

Saratoga Creek/Guadalupe Slough (Station 8½)
July 22, 1975

The Saratoga Creek/Guadalupe Slough crossing is densely bordered by tules. Bird useage is about twice as high as at Alviso. The area is more secluded which may attract the stilts and avocets. The bottom muds appear to be anoxic near the bridge, however.

October 2, 1975

The pickleweed "field" west of Saratoga Slough does not look promising for a salt marsh harvest mouse population, in Ms. Osugi's opinion. She agreed, however, to trap it for information. (See the end of this Appendix for the results of Ms. Osugi's trapping survey.)

Calabazas Creek/Guadalupe Slough (Station 10)
July 22, 1975

Calabazas Creek/Guadalupe Slough is channelized and has little or no emergent vegetation suitable to support wildlife. No birds were observed in the creek bottom.

Unnamed Creek (Station 15)
July 22, 1975

Cliff swallows nest beneath the bridge. No other birds were noted even though the tules are dense. Traffic is moderately heavy on the road; a landfill-motorcycle course is located on the north side of the road.

Sunnyvale Oxidation Ponds/Guadalupe Slough (Near Station 20)
July 22, 1975

The ponds were both supporting significant numbers of ducks. The primary types observed were mallards and ruddy ducks. At least eleven broods of ducks were on the western-most pond, all of which appeared to be mallards. The broods caried in age from less than one month to nearly adult size. A flock of 30 to 40 Wilsons phalaropes were observed on the outfall channel between the two ponds.

The eyebrows northeast of the easterly pond in Guadalupe Slough were heavily populated by western sandpipers, especially at the east end. This eastern area also supported a high density of black-crowned night herons. Avocets and stilts were common. Terns, probably Forsters', were foraging over the main channel of the Slough. The bird activity in this general area was very high , even at midday when the survey was made.

August 14, 1975

When we visited the area at about 12:00 (noon), there were few ducks on the pond, and none with broods of ducklings. Other bird activity was relatively light for the area, probably due to the high tide.

October 2, 1975

The Sunnyvale oxidation ponds, especially the easterly unit, were populated with waterfowl. The east pond had 200 to 300 ducks, primarily shovelers, and coots. Only one shoveler showed any obvious sign of sickness; there was apparently no outbreak of botulism in this area.

Ames Research Magnetic Test Facility (Near Station 34)
July 22, 1975

The fields west of Moffett are mixed annual weeds and low sedges. Ames Research is developing portions of the area to the north for electromagnetic research and has cleared some of the ground above the water influence zone. All areas below sea level are salt marsh and ponds. Waterfowl, mainly pintails and mallards, were observed in significant numbers on the main pond visible from the gate.

October 2, 1975

We visited the gate at Ames magnetic research area, at 9:30 in the morning and at noon. In the morning, the area was very busy, with songbirds feeding on the weed seeds and coming to a small ditch near the fence to drink. Species observed included the meadowlark, house finch, Lincoln's sparrow, song sparrow, and pheasant.

Three white-tailed kites were observed roosting on fences and telephone wires within 1/4 mile of the road to the west. The saline ponds in the middle of the Ames property were supporting only about a dozen ducks in the morning, the majority of which were pintails. We also observed large flocks of white pelicans landing in the salt ponds next to Charleston Slough. In about 5 minutes we counted over 50 birds coming to the ponds in flocks of 8 to 15 from the south, east, and north. We did not attempt to reach the ponds to count the total number of birds present.

During our noon visit, bird activity was greatly reduced. The passerine component which was so abundant in the morning was almost totally missing. The white-tailed kites were not in the area (one was sighted on a telephone wire between Anderson's House Movers and Ames about 2 o'clock in the afternoon). The number of ducks on the Ames saline ponds had increased to nearly the same levels observed on the previous biological survey, perhaps 60 to 75 individuals. The overflights of patrol planes taking off from Moffett do not visibly disturb the birds of the species observed in the area.

Dikes North of Ames Magnetic Test Facility (Stations 34 to 37)
October 21, 1975

Waterbird use of the upland pond was high. A white-tailed kite was observed hovering over the grasslands on the far side of the magnetic test facility and over the dike toward the Moffett landfill. The landfill is being built in an abandoned dry salt pond, just south of salt pond A-2E. The pipeline would cross this dry pond from its southwest corner to the edge of the landfill near the middle of the northeast side.

November 3, 1975

Bird activity on the Ames pond was lover than on past visits. The number of ducks was much reduced. Willets and dowitchers were as abundant as on previous trips. No birds seem to utilize the portion of the pond next to the salt pond dike. Forster's terns were feeding from the salt pond on "minnows." The fish population seemed quite large based on the number of surface ripples seen. We saw female merlin (pigeon hawk) on a fence post of Crittenden Road.

Stevens Creek (Near Station 37)

July 22, 1975

Stevens Creek, though channelized, has a broad margin of rushes on either side of the stream channel and looks like it should be suitable habitat for riparian and mudflat species. There was no evidence, however, of any usage by birds or mammals of the stream. No foot prints were observed in the exposed mud and no birds were flushed from the emergent vegetation. The water and mud near the bridge on Crittenden Road appeared to have a high sediment load which may preclude the development of a significant benthic fauna.

Charleston Slough and Casey Slough (Near Station 47)

July 22, 1975

The following observations were made between 3:15 and 4:00 PM: in the general area of Charleston Slough and the Palo Alto Baylands Reserve, the abundance of birds was markedly reduced compared to Artesian and Guadalupe Sloughs (less than 50 individuals were seen in the entire area), and only one species was unique to this site, the least tern. The least tern was observed feeeding from a small, fresh-water channel immediately north of the abandoned sewage treatment plant, Casey Slough, and nowhere else in this area. This small body of water would seem to be of more importance than others nearby for this reason.

The old oxidation ponds of the Mountain View sewage plant were totally dry and no birds were observed around them. When visited a few weeks ago they had several inches of water in them and we observed ducks (mallards) and several stilts either in the water or on the banks.

August 14, 1975

Least terns were not observed during our visit.

October 21, 1975

Casey Slough--we walked across the outboard dike of the Mountain View landfill/park. We learned that large quantities of water will be pumped from Charleston Slough to fill and maintain the artificial lake being built there. The outer portion of Casey Slough has been covered over by the park development. Waterbird utilization of salt pond 1A was low. Immature Forster's terns were actively feeding. The shallow portions of Charleston Slough were densely populated with shorebirds and waterfowl.

November 3, 1975

About forty ducks were observed on salt pond 1A; they were mainly pintails and shovelers. The pond was by no means crowded. Charleston Slough was covered with resting shore and waterbirds.

Palo Alto Baylands Reserve (Stations 48 to 51)

July 22, 1975

The section of the Baylands Reserve which the pipeline will cross is in one of the dryer portions of the complex and therefore in the section which may have the lowest overall sensitivity. The birds which we did observe included mallards, snowy egrets, common egrets, a great blue heron, avocets, stilts, and a willet. All of these birds were observed in Mayfield Slough and exposed shoreline near Station 48.

October 2, 1975

We visited the Charleston Slough/Bayland Reserve area at 11:30 and about 2:00. We saw no least terns on either visit and generally noted that shorebird activity in the area was low compared with previous observations. We observed an American kestrel and a female marsh hawk foraging in the Reserve. The marsh hawk moved over into Charleston Slough while we were there.

October 21, 1975

The spoils from the Mountain View/Palo Alto conveyance were apparently left in place, forming a "dike" about 2 to 3 ft high across the basin. Grasses and upland weeds grow on this higher area. The immediately surrounding areas are pickleweed. We observed a "family" of pheasants feeding near the freshwater pond. We saw a burrowing owl roosting on a large piece of discarded concrete at the old Mountain View Sewage Treatment Plant.

November 3, 1975

Two American kestrels were foraging within the alignment. One used the nearest (southern) manhole cover as a roost from which to scan the area. Two marsh hawks were perching on the high radio tower next to Casey Slough. Two night herons were standing in the cattails at the edge of Mayfield Slough near the crossing point.

Mayfield Slough (Station 52)
July 22, 1975

The segment of Mayfield Slough immediately adjacent to the city landfill was dry on this visit. Based on an earlier observation of the Slough and on this visit, it appears that it has extremely limited wildlife values in its present condition.

Palo Alto Water Quality Control Plant (Station 56)
November 3, 1975

Pheasants and black-tailed jackrabbits were noted near the plant. Song sparrows were observed foraging in the weeds to the east of the facility about 75 yeards from the salt marsh.

Palo Alto Municipal Airport (Station 58)
July 22, 1975

The "puddle" next to the airport runway was supporting 4 to 6 stilts and several killdeer. Noise from the airport did not appear to disturb the birds. The vegetation in the puddle appears to be upland in nature, not marsh-type.

August 14, 1975

A large number of gulls and other shore birds were wading near or roosting on the island in the middle of the enclosed estuary just east of the aircraft parking area.

October 2, 1975

The usual complement of shore birds were observed on the pond next to the airport runway. We looked for burrowing owls in the area but saw only one, near the paved road at the airport entrance.

November 3, 1975

The pond was again crowded with birds. Species present included least sandpipers, Shovelers, black-necked stilts, and coots. The birds are almost totally undisturbed by landing and departing aircraft.

Palo Alto Salt Marsh (Station 59)
July 22, 1975

A group of night-herons was observed in the center of the marsh. An

Alameda song sparrow was observed singing from a salt bush near the path. The bird moved down to the base of the plant and disappeared in the vegetation. If it were earlier in the year, this behavior would have suggested that the bird had a nest. We did not have time to explore the eastern edge of the salt marsh.

October 2, 1975

At the Palo Alto marsh we observed less than a dozen ducks in the sewage outfall channel, most of which were pintails and mallards.

October 21, 1975

A large number of ducks, primarily pintails, were present throughout the area. Pintails, mallards, coots, and a few wigeons were observed on the sewage channel. Alameda song sparrows were frequently observed in the gumplant which lines the edge of the earthen path and in the interior of the marsh in high clumps of pickleweed. In this area, the species is quite common, if not abundant. The high dike between the airport and the marsh is heavily vegetated with trees, bushes, and high weeds and was heavily utilized by songbirds. We observed flocks of house finches and another sparrow, probably white-crowned, along this dike.

November 3, 1975

Wigeons and pintails were the predominant ducks in the channel; pintails were feeding in the saltbushes which were partially submerged by the high tide. Song sparrows were again very common. White-crowned sparrows were abundant in the bushes around the salt marsh area.

South Bay Dischargers Authority

Environmental Impact Report on Status of salt marsh harvest mouse (*Reithrodontomys raviventris raviventris* Dixon) in South San Francisco Bay.

The salt marsh harvest mouse which is an endemic species of the salt marshes of South San Francisco Bay is the race *Reithrodontomys raviventris raviventris* Dixon. The salt marsh habitat of this mouse, once widespread in South San Francisco Bay, has been reduced in the past few decades to a few comparatively small areas, so that *R. raviventris* Dixon is now listed as an endangered species by both the state of California and the Federal government.

Two factors are responsible for the depletion of salt marsh habitat in the South S.F. Bay. The first and most important of these are diking and landfill operations, which destroy salt marsh habitat completely. The second depleting factor is a general subsidence of salt marsh habitat in the South S.F. Bay, causing major changes in location and distribution of vegetative associations which affect the entire salt marsh community in an adverse manner. For example, between 1956 and 1972, the salt marsh habitat of the Baylands Nature Interpretive Center in Palo Alto has subsided 20 to 50 centimeters. Wondolleck(1975)

A proposed sewage outfall pipeline for the South San Francisco Bay area would cross salt marshhabitat with a potential for supporting populations of salt marsh harvest mice in four areas. From 11 October to 17 October 1975, a small mammal survey was conducted in three of these four areas to determine if they supported populations of the salt marsh harvest mouse. This survey was conducted by Cathy Osugi of the U.S. Fish and Wildlife Service, using live trapping methods. The results of the survey are as follows:

Location: a narrow strip of salt marsh on either side of Alviso Road, north of Highway 237. On 11 and 12 October 1975, a total of 100 traps were set in this area, south of the landfill and north of Gold Street:

100 trap nights

12 *Mus musculus* (House Mouse)
1 *Reithrodontomys megalotis* (Western Harvest Mouse)

13% trap success

These results indicate a fairly good population of *Mus* in this area, probably coming in from the area of the landfill. A small population of *R. megalotis* may also be present, but more trapping would have to be done to verify this. If a population of *R. megalotis* is present in this area, it will probably be facing tough competition from the population of *Mus*.

Location: west of Saratoga Creek (Guadalupe Slough) between Stations 9.0 and 9.5 on the pipeline route. On 14 and 15 October 1975, a total of 100 traps were set in this area, north of the landfill and south of Calabazas Creek:

100 trap nights

1 *Microtus californicus* (California Vole)

1% trap success

Very little can be deduced from these results other than this area is probably of minimal worth as far as supporting any small mammal populations. More trapping in this area would be needed before any definite conclusions could be reached.

Location: Palo Alto Flood Control Basin. On 16 and 17 October 1975, a total of 100 traps were set in the area of the route of the proposed pipeline:

100 trap nights

0 captures

0% trap success

Due to the large size of this area, little can be deduced from only 100 trap nights. However, botanical surveys indicate that the route of the pipeline in this area crosses a poor quality salt marsh community which is dry most of the year and therefore probably incapable of supporting a population of salt marsh harvest mice.

1 December 1975

Michael A. Melanson

Appendix J

AN ASSESSMENT OF THE ARCHAEOLOGICAL AND PALEONTOLOGICAL RESOURCES AS MAY BE IMPACTED BY THE SOUTH BAY DISCHARGERS AUTHORITY'S PROPOSED JOINT OUTFALL PIPELINE

Prepared by Research Services, Incorporated

An Assessment of the Archaeological and
Paleontological Resources as May be
Impacted by the South Bay Dischargers
Authority's Proposed Joint Outfall
Pipeline

Prepared for Bechtel Incorporated
Under Agreement for Technical Services
10035-005-SP-7

Prepared by Archaeological Consulting
and Research Services, Incorporated
20 Evergreen Avenue
Mill Valley, California
August 1975

INTRODUCTION

This report is the result of efforts on the part of Archaeological Consulting and Research Services, Incorporated to gather data relevant to archaeological and paleontological resources as may be impacted by the South Bay Dischargers Authority's proposed joint outfall pipeline. Specifically, we were requested to accomplish the following two (2) tasks:

> Task 1 "Conduct field and archive studies for archaeology and paleontology for the proposed land route of the joint outfall pipeline. Studies shall include the examination of all available records concerning archaeological and paleontological resources in the vicinity of the proposed pipeline route and an in-field surface reconnaissance of the entire proposed corridor."

> Task 2 "Prepare a report setting forth the archaeological and paleontological data gathered under Task 1. This report shall include photographs, maps and other graphics as necessary to fully and accurately describe the nature and extent of the cultural and paleontological resources encountered. The report shall evaluate the significance of the resources and the impacts which these resources may sustain should the project be undertaken. The full range of mitigation procedures which may be required if the project were undertaken shall be discussed and an evaluation made of the "no project" null hypothesis."

Our research was addressed directly to that outfall pipeline alignment which would begin at a pumping station near the San Jose/Santa Clara treatment plant, proceed north adjacent to San Francisco Bay to the Palo Alto treatment plant, and continue along that line designated as "Option 2" on Figure 5-1 in the project draft EIR of December, 1973. The data as compiled toward the completion of the above job tasks is organized in the following text to discuss:

- Research Methodology
- Archaeological and Paleontological Resources Which May be Impacted Should the Project be Undertaken
- Impacts on Archaeological and Paleontological Resources
- Mitigation Procedures

RESEARCH METHODOLOGY

Prior to the in-field reconnaissance of the pipeline route, maps and records on file at the Society for California Archaeology District Clearinghouse Number 4 at San Francisco State University were examined for information regarding previsouly recorded known archaeological sites or completed archaeological reconnaissances in the vicinity of the proposed project. Additionally, records of the same type as previously obtained by our firm from the Society for California Archaeology District Clearinghouse Number 5 at Cabrillo College in Aptos were also examined.

Records and reports pertaining to paleontological resources in the proposed project area were obtained and consulted at the United States Geological Survey facilities in Menlo Park, California.

An archaeological reconnaissance of the on land alignment of the outfall pipeline was completed by Mr. Thomas L. Jackson and Mr. Stephen A. Dietz of Archaeological Consulting and Research Services, Incorporated. The entire on land route of the proposed pipeline was subject to a visual surface examination. This was accomplished by inspecting on foot a corridor of at least one hundred (100) feet on either side of the approximate alignment centerline.

We would like to thank Lieutenant Commander Sayner, Assistant Public Works Officer at Moffett Field, and Mr. Bob Eddy of Ames Research

Center for their kind assistance and for allowing us access to those properties under their jurisdiction which are involved with the pipeline route.

ARCHAEOLOGICAL AND PALEONTOLOGICAL RESOURCES WHICH MAY BE IMPACTED SHOULD THE PROJECT BE UNDERTAKEN

Archaeological Resources

Maps and records on file at the Society for California Archaeology Clearinghouses indicated that although there are a number of known archaeological resources within the region of the proposed project, there are no known archaeological resources within the corridor of the outfall pipeline route as investigated by ACRS. In addition, no indications of archaeological remains were observed or discovered during the in-field reconnaissance. No concentrations of shell, baked clays or fire cracked rock, soil color changes, vegetation changes, faunal or lithic materials, artifacts or any other indicators which may signify the presence of archaeological resources were encountered.

This does not, however, preclude the possibility of there being subsurface archaeological resources within the proposed pipeline alignment. A number of archaeological resources have recently been discovered along the San Francisco Bay which have, through time, been covered by thick dune, stream, and estuary deposits.

In October 1969 during the excavation for the San Francisco Civic Center Station of the Bay Area Rapid Transit District, human remains were found at a depth of seventy-five (75) feet below the present ground surface. The bones were contained within a matrix of clayey silt which is overlain by a 20-foot layer of dune sand and a higher layer of artificial fill built up since 1853 A.D. Microscopic examinations of the clayey silt and organic materials adhering to the remains indicated that there had once existed at the site of the discovery a marshland setting at or near a stream valley. Most surprising was the results of a radiocarbon analysis of the associated organic materials which produced a date of 2950 B.C. This was one of the earliest representations of human occupation in the Bay Area (Henn, et al., 1972; Henn, et al., 1973).

A similar discovery was made in 1951 which is in the immediate vicinity of the proposed project. During summer of that year, construction activities related to the development of a subdivision in East Palo Alto exposed a large number of human burials at depths ranging from 3½ to 6½ feet. Archaeological investigations by Dr. Bert A. Gerow of Stanford University produced cultural remains which suggested the existence of a large village complex which had been buried under alluvial materials from San Francisquito Creek. Materials from the site, which has been designated as SMa-77, yielded a radiocarbon date of 1200 B.C. (Gerow, 1968).

Of interest to this study is the fact that the village complex was once situated on the natural levee of San Franciscquito Creek which at the present time is more than a mile away from SMa-77. Helley and Brabb (1971) and Lajoie, et al. (1974) have mapped the alluvial deposits associated with San Francisquito Creek as well as a number of other areas which contain similar materials. Designated as Qyfo and Qyf deposits of the late Cenozoic on the enclosed map (colored Yellow), they are described by Lajoie, et al. (1974) as being, respectively, fine grained younger alluvial fan deposits which are unconsolidated, moderately-sorted, moderately permeable fine sand, and coarse grained younger alluvial fan deposits which are unconsolidated, moderately sorted, permeable sand and silt with coarse sand and gravel becoming abundant toward fan heads and narrow canyons. Qyfo deposits are noted as having a thickness which varies from 0 to 12 feet and Qyf deposits vary in thickness from less than 10 feet to as much as 50 feet. Qyf deposits "locally contain aboriginal artifacts and skeletal remains". Both deposits are presently forming with the oldest deposits probably dating from 5000 to 7000 years old.

The Qyfo and Qyf deposits, then, are levee deposits which can betray old stream channels along which sites like SMa-77 are located. As such, it is important to note that a number of Qyfo depositions are shown on the enclosed Helley and Brabb map which intersect with or are near the alignment of the proposed outfall pipeline. Those Qyfo deposits which are shown to be overlain Qobm deposits (actually Qym deposits or young bay mud, Lajoie, 1975) most likely continue under the young bay mud and cross the alignment route. These areas of Qyfo and Qyf deposition should, then, be considered as having a high probability for containing subsurface or buried archaeological resources.

Paleontological Resources

The paleontological resources of the margins of the present San Francisco Bay have not been the focus of geological investigations until recent attempts to map and define late cenozoic (particularly late Quaternary) sediments along the Bay margins (cf. Helley and Brabb, 1971 and Lajoie, Nichols and Burke, 1974). Of particular interest to the present study is the recent paper by Helley, Adam and Burke (1972), "Late Quaternary Stratigraphic and Paleoecological Investigations in the San Francisco Bay Area", which describes biostratigraphic studies conducted at the Mountain View Dump. Sanitary landfill operations at the dump have exposed a varied and rich fossil flora and fauna of late Pleistocene and Holocene age (Helley, Adam and Burke 1972:21). Among the fossil flora recovered from the Mountain View dump are remains of *Libocedrus decurrens*, *Cupressus* sp., *Psuedotsuga*, *Pinus* sp., *Juniperus* (?), *Zannichellia palustris*, *Elatine californica*, *Potamogeton* sp., *Xanthium strumarium*, *Dichondra* sp. and pollen grains from several faunal species. Molluscan remains identified from the strata of the Mountain View dump include *Anodonta* sp., *Sphaerium* sp., *Musculium* (?), *Gyraulus parvus*, *Lymnaea* sp. (?), *Physa* sp., *Succinea* sp. and *Valvata humeratus* (Helley, Adam and Burke, 1972:26-27, Tables 2 and 3). Vertebrate faunas recovered from the Mountain View dump include *Equus*, *Bison*, *Camelops*, *Mammuthus*, and a ground sloth, *Mylodon harlani*. Also recovered are the remains of *Neotoma* cf. *lucipes*, *Dipodomys* cf. *heermani*, and *Eumeces* (?). Fish remains were also recovered from the strata of the dump (Helley, Adam and Burke, 1972:27).

Wood remains from the dump recovered from elevations of -6.1, -6.3, and -7.0 meters below present mean sea level have yielded radiocarbon dates of 20,820±320, 21,960±520 and 23,000±500 years B.P. respectively.

Other paleontological discoveries have been made adjacent to the present project area along San Francisquito Creek (Santa Clara County Planning Department, 1973) and in the marshlands near Sunnyvale (Lajoie, 1974).

IMPACTS ON ARCHAEOLOGICAL AND PALEONTOLOGICAL RESOURCES

Archaeological Resources

Direct impacts upon archaeological resources will occur if the construction activities associated with the development of the proposed project encounter any subsurface remains. As demonstrated earlier (cf. Archaeological and Paleontological Resources Which May be Impacted Should the Project be Undertaken, this report) this would appear to be a distinct possibility. Given the depth of the Qyfo and Qyf deposits, archaeological resources could certainly be contained within the limits of the trenching activities and if so, would be damaged or destroyed.

Indirect impacts upon archaeological resources could occur through growth as induced by the proposed project. Archaeological resources situated in areas of future induced growth could be damaged or destroyed by development activities.

Paleontological Resources

It seems likely that the construction of the proposed pipeline will encounter numerous paleontological remains along the proposed route. The significance of these remains will be variously interpreted, depending upon the particular interest of the geologist or paleontologist consulted. Nevertheless, it may be regarded that any remains encountered will contribute to our understanding of the geologic history and the paleoecological history of the San Francisco Bay Area.

Remains of large vertebrates are the most striking fossil remains which may be encountered by the project. The likelihood of encountering such remains is considered high and may result in considerable popular as well as scientific interest. Excavations into present sediments will afford geologists an opportunity, as at the Mountain View dump, to study the stratigraphy of the Bay margins and to collect fossil floras and faunas.

MITIGATION PROCEDURES

Archaeological Resources

The following are submitted as possible mitigation procedures for impacts upon archaeological resources:

1. No Project. This alternative would obviously negate any possibility of impacts upon archaeological resources through construction activities or growth inducement.

2. Avoidance of those areas which may contain archaeological resources. This alternative would require modifications to alignment and/or installation design elements so as to avoid disturbance of Qyfo and Qyf deposits.

3. Subsurface examinations of those portions of the pipeline route which contain Qyfo and Qyf deposits. This alternative would require the use of augering or backhoe equipment to examine subsurface soils in those areas which may contain archaeological resources. The presence or absence of archaeological remains would determine the necessity of additional archaeological investigations for the recovery of cultural materials prior to the construction of the pipeline.

4. Monitoring of excavations for the installation of the pipeline. This alternative would require that a qualified archaeologist or qualified archaeologists be present during the excavation of the pipeline trench through those areas which may contain archaeological resources. Should archaeological resources be encountered, this alternative would necessitate the halting of trenching activities in those locations until the resources have been subject to removal through scientific archaeological excavations.

5. Excavation of proposed pipeline trench without subsurface examinations or monitoring. This alternative would mean the destruction and loss of any subsurface archaeological resources which may be within the route of the pipeline trench.

Paleontological Resources

The mitigation procedures for paleontological resources would essentially be the same as those for archaeological resources. The possibilities include:

1. No Project. Same as with archaeological resources.

2. Avoidance of those areas which may contain paleontological resources. This alternative does, however, seem far more difficult to achieve than with archaeological resources because of the higher probability that paleontological resources may be found anywhere along the alignment route.

3. Subsurface examinations within the alignment corridor. As with archaeological resources, this alternative would require the use of equipment to examine subsurface soils and is intended to determine if the proposed project will encounter subsurface paleontological remains. The presence or absence of such remains would again determine the necessity for additional paleontological investigations.

4. Monitoring of excavations for the installation of the pipoline. Same as with archaeological resources but with qualified paleontologist(s) present.

5. Excavation of proposed pipeline trench without subsurface examinations or monitoring. This alternative would mean the destruction and/or loss of any subsurface paleontological resources which may be within the route of the pipeline trench.

RECOMMENDATIONS

Archaeological Resources

It is our recommendation that the following course of action be taken to deal with the possibility of the presence of archaeological resources. Prior to the excavation of the outfall pipeline trench, subsurface examinations should be undertaken to inspect those areas which may contain archaeological resources (i.e., Qyfo and Qyf deposits). Soil and geological profiles as may be prepared for the completion of the proposed project could be utilized to delineate the areas to be tested.

At this point in time, the available data does not allow us to make an absolute determination about the presence or absence of archaeological resources within the alignment corridor. It is this uncertainty which necessitates as many mitigation alternatives as have been proposed. If by subsurface testing it is determined that no archaeological resources will be encountered, there will obviously be no need for any further mitigative measures. The presence of archaeological resources would require additional investigations by qualified archaeologists and would most likely mean the removal of any cultural remains which would suffer destruction or damage by project activities. The subsurface testing could be accomplished through the use of augering or backhoing equipment. In those areas where, because of groundwater or other conditions it is not possible to conduct subsurface testing, monitoring of trenching activities may seem a viable alternative.

Paleontological Resources

It is recommended that members of the United States Geological Survey, Menlo Park, and the California Division of Mines and Geology, San Francisco and Sacramento, be appraised as to the nature of the project to be undertaken and consulted as to the ways by which members of these agencies may take advantage of the project to investigate the paleontology of the pipeline route. Agency representatives may be contacted through ACRS which will serve as a liason if necessary.

REFERENCES

Gerow, Bert A. An Analysis of the University Village Complex.
1968 Stanford University.

Helley, E. J. and E. E. Brabb Geologic Map of Late Cenozoic
1971 Deposits, Santa Clara County California.
United States Department of the Interior.

Helley, E. J., Adam, David P. and Dennis B. Burke Late
1972 Quaternary Stratigraphic and Paleoecological
Investigations in the San Francisco Bay Area in
Progress Report on the U.S.G.S. Quaternary
Studies in the San Francisco Bay Area, pp. 19-
30. United States Department of the Interior.

Henn, Winfield, Jackson, Tom and Julius Schlocker Buried
1972 Human Bones at the 'BART' site San Francisco in
California Geology, Vol. 25, pp. 208-209.

Henn, Winfield, Jackson, Tom and Julius Schlocker Recent
1973 Discoveries of Early Archaeological Sites in the
San Francisco Bay Area in The Geological Newsletter,
Vol. 39, No. 3, pp. 26-27. The Geological Society
of the Oregon Country, Portland.

Lajoie, K. R., Helley, E. J., Nichols, D. R. and D. B. Burke
1974 Geologic Map of Unconsolidated and Moderately
Consolidated Deposits of San Mateo County,
California. United States Department of the
Interior.

Lajoie, K. R. Personnal Communication
1974

1975 Personnal Communication

Peterson, John A. and Dr. Ernst M. Mihelits Environmental
1973 Impact Report. Overall Program for Water Quality
Management in South San Francisco Bay. Bechtel
Incorporated, San Francisco.

Appendix K

EXCERPTS FROM BASSA (1975) REPORT ON WATER QUALITY

SAN FRANCISCO BAY REGION
WASTEWATER MANAGEMENT FACILITIES

PROJECT COORDINATION PROGRAM

REPORT – JULY 1975
FOR

bassa

BAY AREA SEWAGE SERVICES AGENCY
CLAREMONT HOTEL, BERKELEY, CALIFORNIA

J.B. GILBERT AND ASSOCIATES
SACRAMENTO AND BERKELEY

SUMMARY AND CONCLUSIONS

SCHEDULE STUDIES

Latest available scheduling and cost information on all projects in the Bay Area grant-funded wastewater management facilities program was assembled. Using this information, a project implementation schedule in the form of a bar-chart was prepared for each project. These charts are published separately as Appendix A.

Various analyses were performed using this schedule data. Cash flows for engineering and construction activities, project review work loads, bid date schedules, compliance date overruns, and a project construction schedule analysis were obtained. These are presented and discussed in Chapter III.

The major conclusions from the schedule studies are as follows:

1. The peak rate for engineering activity for the program will come in early 1976. Some staffing problems may be encountered for a few months in early 1976.
2. The State Board Grants Section is presently able to meet the review work load and should be able to continue to do so.
3. The rate of construction activity is expected to peak at about $30 million per month in 1978. The construction industry will very probably be able to absorb the peak construction rate with little strain.
4. Delivery schedules on major equipment are always long, but excessive delays are not anticipated. Pre-purchase of equipment may be indicated in some cases.
5. Pipeline construction is expected to peak rather sharply. There may be competition for larger pumping units, possibly leading to delays.
6. Shortages of labor and common materials are not anticipated. However, it would be advisable to monitor these markets periodically.

7. Clustering of several bid dates into a short time period can lead to a reduced number of bids submitted and, thus, to higher bids. Monitoring of project schedules and management of bid dates to avoid conflicts is recommended.

8. A number of jobs now face overruns of NPDES compliance dates, and the list may grow. The use of compliance dates to stimulate progress toward implementation should be handled with sensitivity by the regulatory agencies.

9. Around 20 percent of the projects have allotted construction times that may be unrealistically short. It is recommended that schedules for these projects be reviewed. For most of these projects, schedule adjustments could be made with little adverse consequence if so indicated.

10. Schedule changes and delays can have impacts on water quality, can create or reduce competition between projects for services and materials, and can even alter the economic climate of the whole program. Monitoring of progress of jobs and updating of schedule information can provide the data to predict and deal with these effects.

WATER QUALITY

The effect on the water quality in San Francisco Bay of the grant-funded wastewater facilities program was assessed by using mathematical model results. Several previous studies had produced predictive water quality coefficients through the use of mathematical models. These predictive coefficients were used in this study, and the resulting information is presented in Chapter IV.

The major conclusions on water quality are as follows:

1. Projects in the South Bay are the most critical. Those south of Dumbarton Bridge are the most critical in the South Bay.
2. Water quality problems in areas of the bay north of the Richmond Bridge do not appear to exist, although there may be very local effects at discrete discharge locations.
3. South of Dumbarton Bridge, treatment to the level of the NPDES permits appears to improve dissolved oxygen values to the required levels. However, this conclusion should be viewed with some caution because a number of factors have not been included in these analyses.
4. The removal of discharges from south of Dumbarton Bridge will reduce the bay's maximum wastewater percentage from 47 percent to 7 percent. The potential problems in the South Bay, which could result from high wastewater concentrations, will be largely alleviated.
5. The impact in 1980 of relocating the primary discharge of San Francisco's North Point Plant to the Southeast location is very evident. The resulting concentration peak seems well below any limiting level, however.

Public Law 92-500 is the major impetus behind the grant-funded facilities program, both in the Bay Area and nationally. In accordance with the water quality requirements of the act, the Environmental Protection Agency has set a minimum interim standard for all dischargers of 85 percent removal of BOD (secondary treatment). It would appear from the results of analyses in this study that this is the governing requirement for many of the projects in the program, as opposed to alleviation of specific receiving water problems.

PROBLEMS AND PROBLEM SOLUTIONS

The complexity and diversity of the $1.5 billion grant-funded wastewater management program in the Bay Area guarantee that problems will occur. Chapter V describes the problem areas that have been identified and recommends means of dealing with them.

Major conclusions are as follows:

1. The types of potential problems are varied. All types identified are significant in terms of value of projects involved. The most significant problem areas in terms of dollars are adverse public reaction and scheduling problems.
2. Public agencies can take a variety of effective actions in dealing with problem areas.
3. There is a significant role for BASSA in problem solution. It will require aggressive action, especially in the area

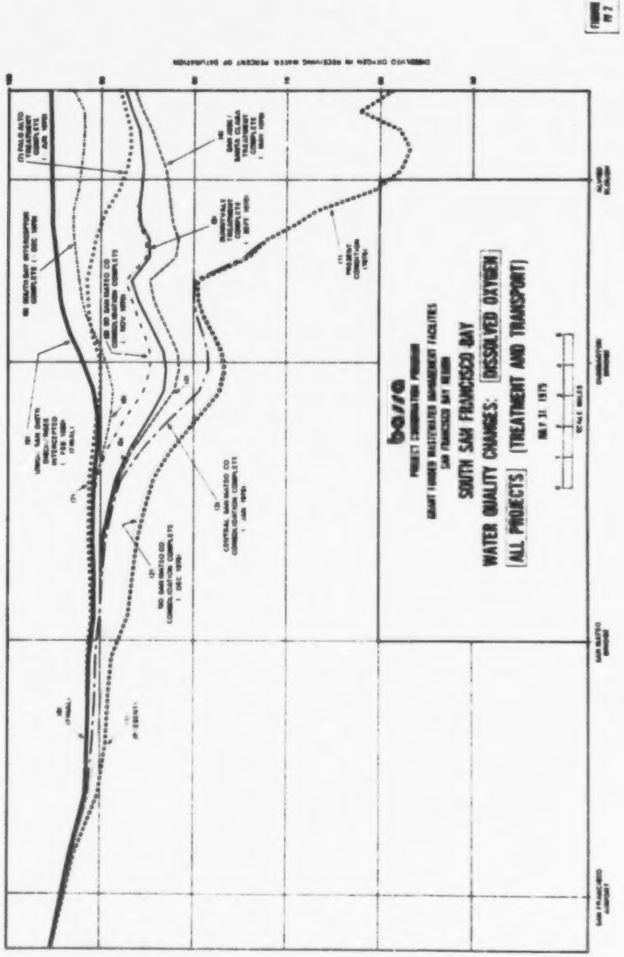
of scheduling, including the coordination of bid dates, the establishment of realistic schedules, and the reconciliation of reasonable schedules with NPDES permit compliance schedules where the two differ.

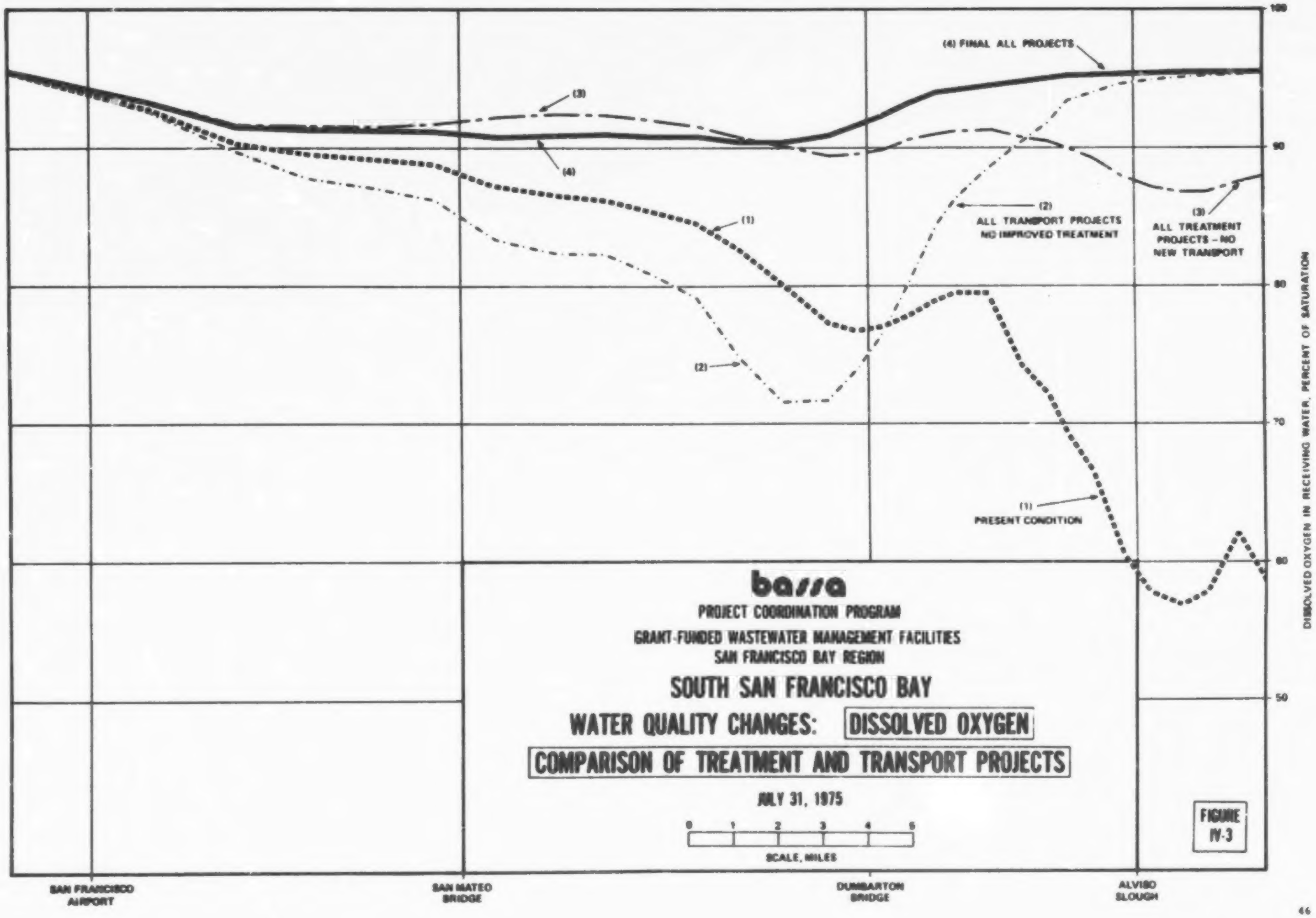
For the sake of efficiency and accuracy, a short data processing computer program was written to produce all results plotted in this chapter. The program used the appropriate predictive coefficients and calculated all concentrations. The input was the appropriate waste loads.

The following limitations and conditions apply to the results given in this chapter:

- The results displayed are based on steady-state conditions.
- The available matrix load points do not always coincide with the real waste load input points. Where points are not coincident, the nearest matrix input point is used.
- Industrial dischargers not tributary to municipal systems are not included.
- Municipal dischargers' projects that are not part of the grant-funded program are not included.
- Analyses are for the dry season. Storm runoff inputs are not included.
- Background pollutant inputs, e.g. from the atmosphere, the ocean, and dry weather stream flows are not included.
- The NPDES permit requirements for treatment levels and relocations/consolidations are used to represent effluent quality after project completion. Present discharge rates are used throughout.
- The discharger agencies' current schedules of completion dates from the project implementation schedules (Appendix A) are used.

This study does not attempt to evaluate and justify individual projects in the grant-funded program. The results obtained are relative, not absolute, because of the limitations listed above. The intention of this portion of the work is simply to compare on that relative basis water quality impacts of the various projects. It is hoped that this will aid decision-making in the process toward implementation.





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PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

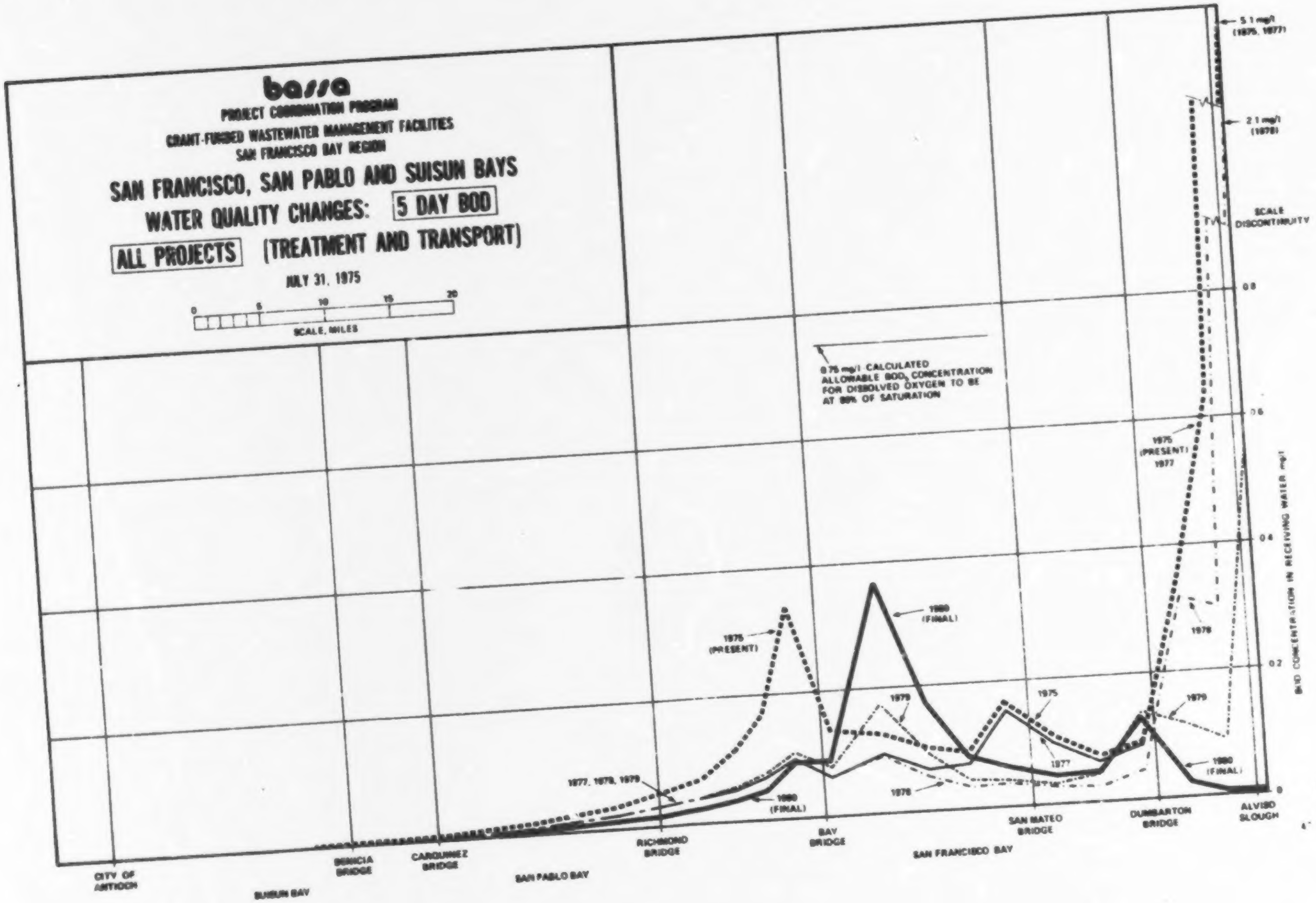
SOUTH SAN FRANCISCO BAY

WATER QUALITY CHANGES: DISSOLVED OXYGEN

COMPARISON OF TREATMENT AND TRANSPORT PROJECTS

JULY 31, 1975

FIGURE
IV-3



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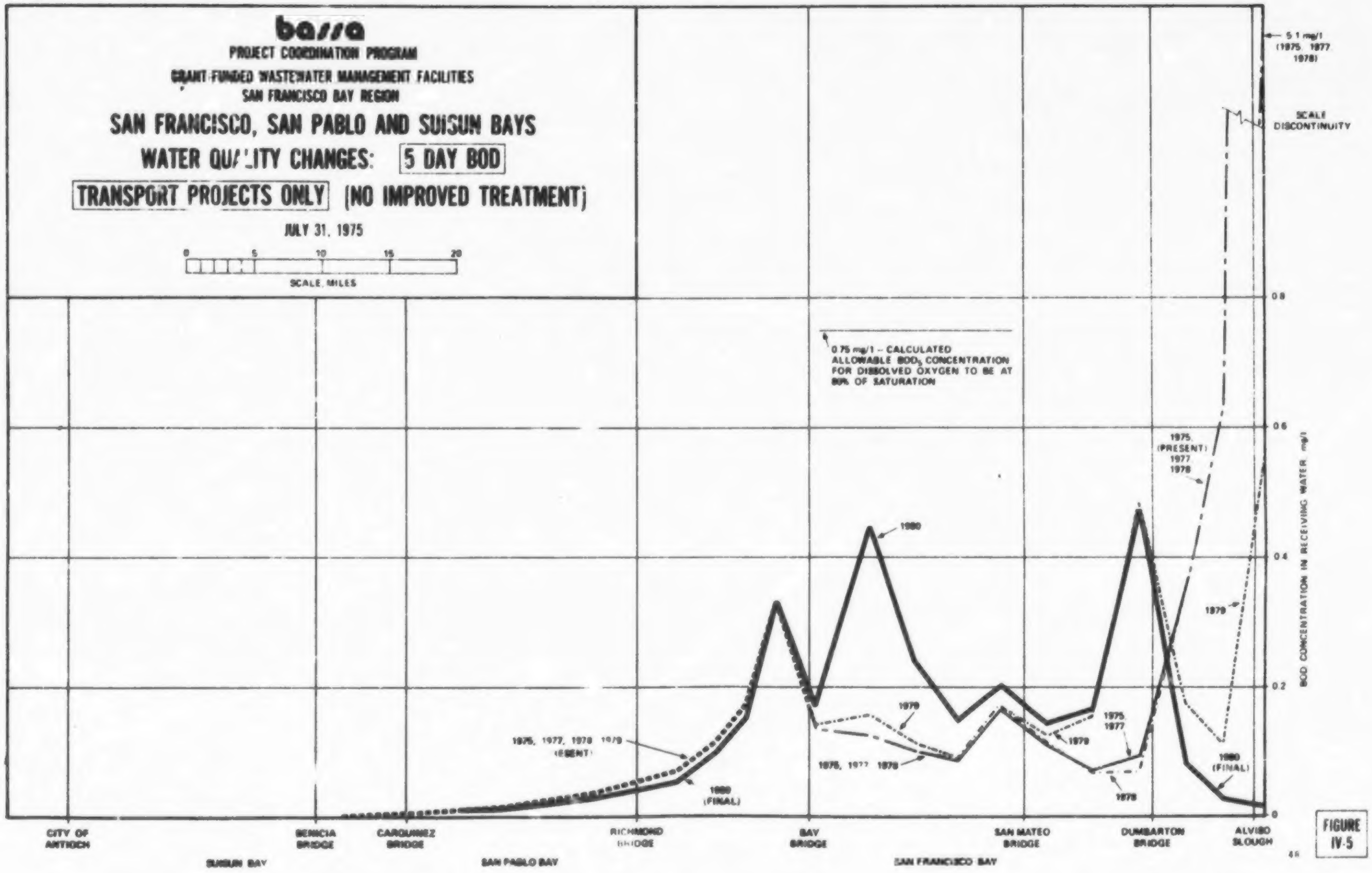
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: 5 DAY BOD
ALL PROJECTS (TREATMENT AND TRANSPORT)

JULY 31, 1975

FIGURE IV-4



bassa

PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

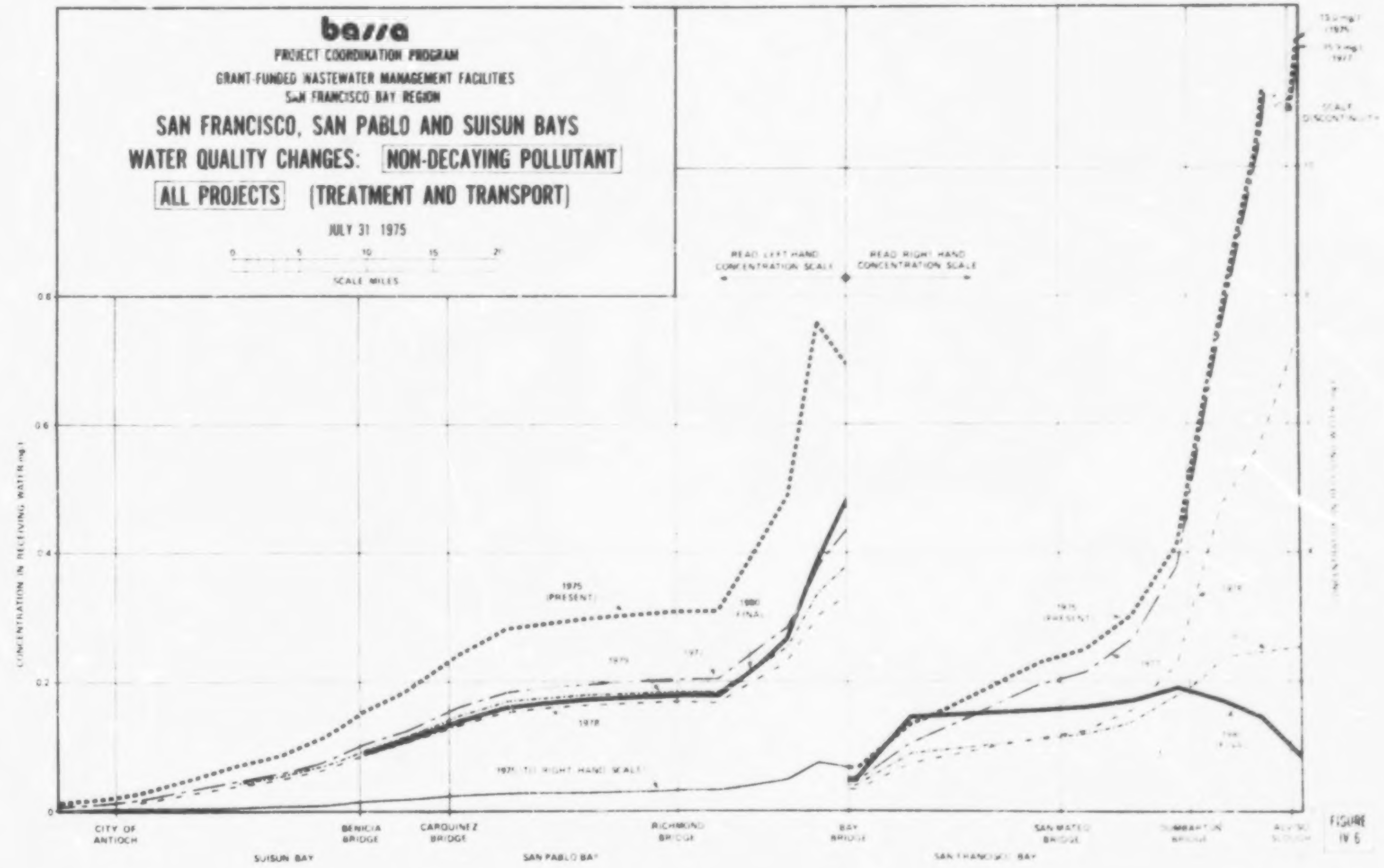
SAN FRANCISCO, SAN PABLO AND SUISUN BAYS

WATER QUALITY CHANGES: 5 DAY BOD

TRANSPORT PROJECTS ONLY (NO IMPROVED TREATMENT)

JULY 31, 1975

FIGURE IV-5



bassa

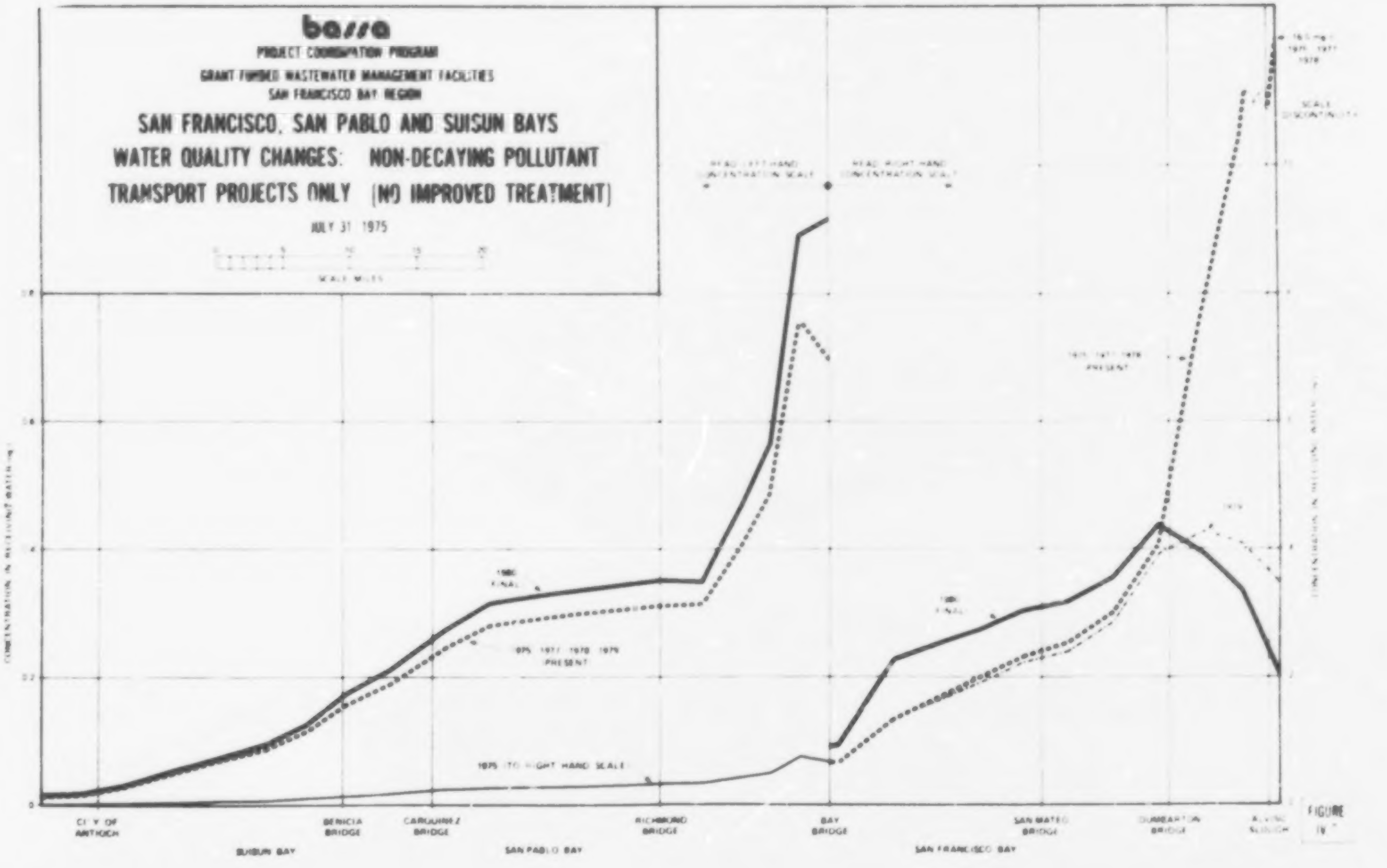
PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: NON-DECAYING POLLUTANT
ALL PROJECTS (TREATMENT AND TRANSPORT)

JULY 31 1975

FIGURE IV 6



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PROJECT COORDINATION PROGRAM

GRANT FUNDED WASTEWATER MANAGEMENT FACILITIES

SAN FRANCISCO BAY REGION

SAN FRANCISCO, SAN PABLO AND SUISUN BAYS

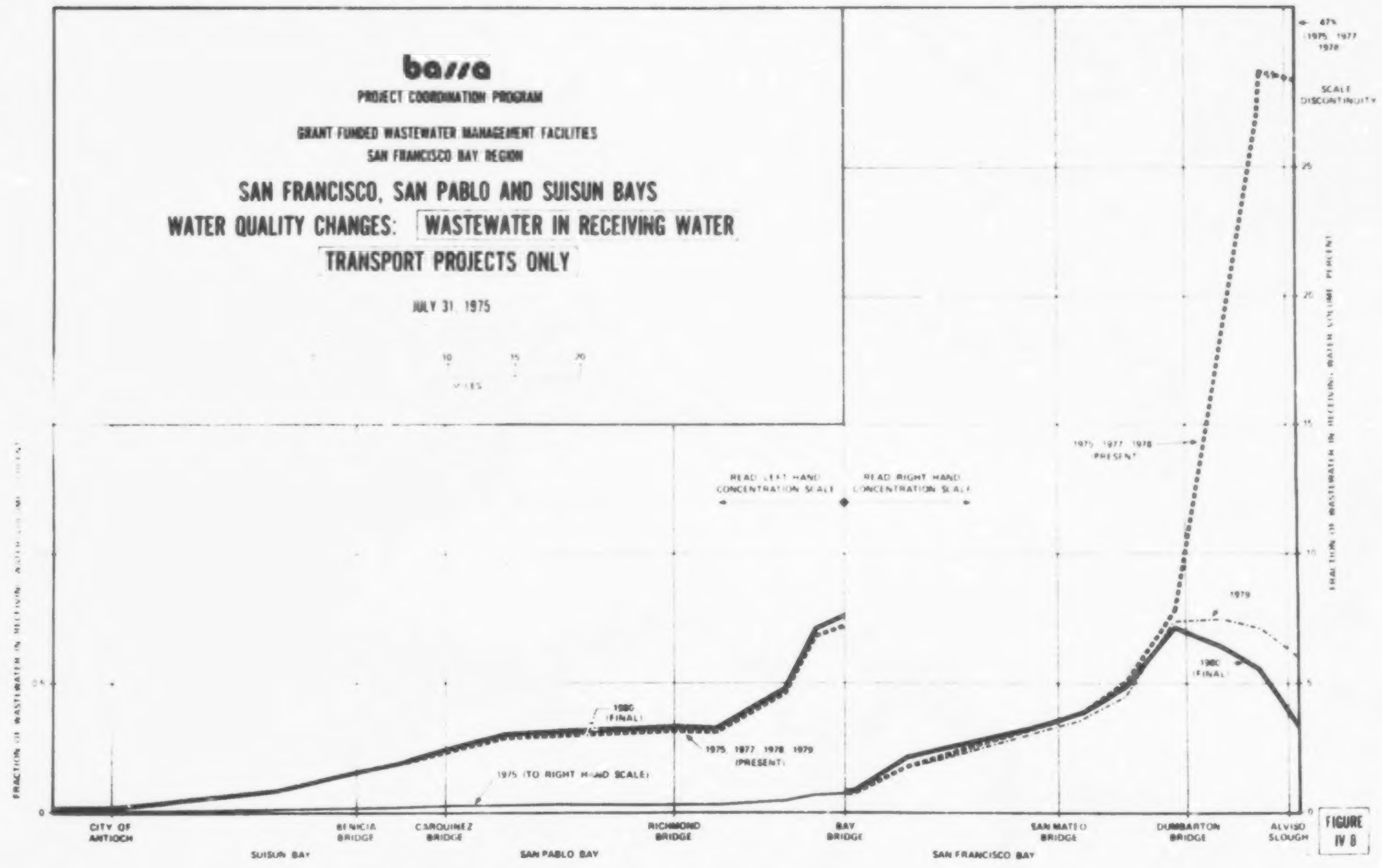
WATER QUALITY CHANGES: NON-DECAYING POLLUTANT

TRANSPORT PROJECTS ONLY (NO IMPROVED TREATMENT)

JULY 31 1975

FIGURE IV-7

K-8



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PROJECT COORDINATION PROGRAM

GRANT FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: WASTEWATER IN RECEIVING WATER
TRANSPORT PROJECTS ONLY

JULY 31, 1975

FIGURE IV 8

Appendix L

FEDERAL, STATE, AND REGIONAL LAWS, REGULATIONS, AND PLANS

In the past five years, a number of federal, state, and regional laws, regulations, and plans have been enacted to protect and enhance the quality of the waters of the Nation and California. These include regulations and laws that are enforceable, as well as policies and guidelines which set the direction for the achievement of goals expressed in the laws. In the San Francisco Bay Area, a number of regulatory bodies and governmental units are involved in the formulation and enforcement of these policies. Compliance with the water quality program, as defined by these policies was of primary importance in the selection of an appropriate method of disposal of treated wastewaters in south San Francisco Bay.

Complete texts of selected regulations are presented below with summary introductory paragraphs of the requirements and compliance schemes of these policies. The reader is also referred to the Tentative Water Quality Control Plan Report, San Francisco Bay Region (2), prepared for the State Water Resources Control Board (November 1974) for a summary of the policies and guidelines used in delineating the basin plan.

L. 1 FEDERAL LAWS AND REGULATIONS

In October 1972, Public Law 92-500 was passed by Congress. This law, known as the Federal Water Pollution Control Act (FWPCA), provides for the restoration and preservation of the quality of the Nation's waters. It established the National Pollutant Discharge Elimination System (NPDES), a national permit program with compliance schedules for achieving the goal of compliance with water quality standards. Under this system, the State of California must establish water quality standards, treatment standards, or discharge requirements, and discharges must achieve the treatment necessary to meet these objectives by 1 July 1977. In order to promote this compliance, Public Law 92-500 established research and grant programs to develop and implement wastewater management plans. Grant programs, such as the one under which the SBDA facilities management plan has been developed, are jointly administered by federal (EPA) and state (SWRCB) governmental agencies.

L. 2 STATE PLANS AND POLICIES

The State Water Resources Control Board (SWRCB) of California has formulated water quality plans for the state's water resources. Two of these plans directly affect the selection of an alternative in the SBDA program.

The Water Quality Control Plan for Ocean Water of California (July 1972) sets limits on the bacteriological, physical, chemical, biological, toxicity, and radioactive characteristics for ocean waters and for effluent quality. These limits were devised to protect the industrial water supply, recreation, aesthetic enjoyment, navigation, and marine resources such as fish, wildlife, and areas of special biological significance. The plan went into effect 6 July 1972, and dischargers to the ocean were to file reports by 1 January 1973 on waste treatment programs that ensured compliance. The SWRCB is responsible for reviewing and approving time schedules for such compliance.

The Water Quality Control Policy for Enclosed Bays and Estuaries of California (May 1974) contains two specific provisions that affect the choice of a disposal alternative for SBDA. The first is that the "State Board and the San Francisco Regional Board shall take such action as is necessary to assure the elimination of wastewater discharges to waters of the San

Francisco Bay, south of Dumbarton Bridge, at the earliest practicable date" (Chapter I, paragraph B. 1b). The second is that "where a discharger has an alternative of in-bay or ocean disposal and where both alternatives offer a similar degree of environmental and public health protection, prime consideration shall be given to the alternative which offers the greatest degree of flexibility for the implementation of economically feasible wastewater reclamation options" (Chapter I, paragraph B. 2). General limits on wastewater discharges are also imposed, with the effective date of the plan being May 1974. Staged implementation of treatment programs to comply with these goals and time schedules for compliance are to be reviewed by the Regional Board.

Wastewater Reclamation Criteria (California Administrative Code, Title 22, Division 4, Environmental Health, 1975) establishes acceptable levels of constituents in reclaimed water for irrigation and for recreational impoundments. The policy of the state to encourage reclamation (defined in Sections 13510-13512 of the California Water Code) is reflected in these criteria.

The Porter-Cologne Water Qualtiy Control Act (1974) sets forth the goals and policies of the state, establishes the responsibilities of the State Water Resources Control Board and the Regional Water Quality Control Boards, and provides for funding of water quality control projects.

L. 3 REGIONAL PLANS, POLICIES, AND AGENCIES

As a patron of a comprehensive planning effort for the development of water quality control plans for the State of California, Brown and Caldwell (1974) prepared a Tentative Water Quality Control Plan, San Francisco Bay Basin (2), herein called the Tentative Basin Plan. The goals of this plan include the satisfaction of four objectives:

(1) Satisfy the requirements of the U. S. Environmental Protection Agency for the allocation of grant funds.

(2) Satisfy the requirements of the Porter-Cologne Act for water quality control plans.

(3) Provide a basis for establishing priorities in the disbursement of grant funds.

(4) Delineate water quality objectives to be achieved and maintained.

In formulating the Tentative Basin Plan, the authors endorsed the SBDA facilities management plan as described by Bechtel (1974) and found reclamation and reuse by groundwater recharge to be "uncertain until the significance of potential health hazards from residual organics in wastewater are clearly defined."

The text on effluent limitations and recommended water quality objectives, as presented in the Tentative Basin Plan, are presented below.

Bay Area regional agencies with influence over wastewater management include the Association of Bay Area Governments (ABAG – planning for water, sewerage, and drainage development), San Francisco Bay Conservation and Development Commission (BCDC – construction in the Bay, salt ponds, or marshlands), and the Bay Area Sewage Services Agency (BASSA – regional water quality management planning and construction and operation of required facilities).

L.4 DESIGNATED PRESERVES AND LAND-USE PLANNING

In the area of south San Francisco Bay, a number of acres of land have been designated as wildlife refuges or Baylands preserves. The use of portions of these areas as preserves constitutes a beneficial use of Bay waters, and, therefore, waste treatment and disposal would have to protect and enhance these areas. These preserves include the San Francisco National Wildlife Refuge (U.S. Department of Interior, Fish and Wildlife Service administering), the Palo Alto Baylands Preserve (City of Palo Alto), the Mountain View Baylands Park, the Sunnyvale Baylands Park, and the proposed Santa Clara County Baylands Park system (including Charleston Slough, Salt Pond No. 1, a portion of the Sunnyvale Baylands Park, a portion of New Chicago Marsh, and portions of the Coyote Creek Park system).

In conjunction with the water quality planning and parkable designation, the County of Santa Clara and the Cities of San Jose, Santa Clara, Sunnyvale, Mountain View, and Palo Alto have developed land-use plans that provide for development compatible with the beneficial use of the Bay waters and marshes. While these plans may conflict somewhat (Section II-2, Land Use), all include a moratorium on development in the Baylands marshes, sloughs, and salt ponds. Construction in these areas must be compatible with the proposed use of the land and water for propagation of fish and wildlife, for recreation, and as open space.

L.5 DISCHARGER AUTHORITY

In order to comply with the above described laws, policies, and plans, regional wastewater management studies have been performed. As a result of these studies, the South Bay Dischargers Authority, which consists of regional treatment facilities at San Jose/Santa Clara, Sunnyvale, and Palo Alto, have formulated a wastewater management plan that includes upgrading of current (1974) treatment levels and removal of the discharges of wastewater from south of Dumbarton Bridge. It is this management plant that has led to to the approval by the EPA and the state of treatment upgrading and to the preparation of an engineering, economic, and environmental analysis of disposal methods.

Public Law 92-500
92nd Congress, S. 2770
October 18, 1972

An Act

To amend the Federal Water Pollution Control Act.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Federal Water Pollution Control Act Amendments of 1972".

Federal Water Pollution Control Act Amendments of 1972.
70 Stat. 498;
84 Stat. 91.
33 USC 1151 note.

SEC. 2. The Federal Water Pollution Control Act is amended to read as follows:

"TITLE I—RESEARCH AND RELATED PROGRAMS

"DECLARATION OF GOALS AND POLICY

"SEC. 101. (a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act—

"(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;

"(2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;

"(3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

"(4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works;

"(5) it is the national policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State; and

"(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

"(b) It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources, and to consult with the Administrator in the exercise of his authority under this Act. It is further the policy of the Congress to support and aid research relating to the prevention, reduction, and elimination of pollution, and to provide Federal technical services and financial aid to State and interstate agencies and municipalities in connection with the prevention, reduction, and elimination of pollution.

"(c) It is further the policy of Congress that the President, acting through the Secretary of State and such national and international organizations as he determines appropriate, shall take such action as may be necessary to insure that to the fullest extent possible all foreign countries shall take meaningful action for the prevention, reduction, and elimination of pollution in their waters and in international waters and for the achievement of goals regarding the elimination of discharge of pollutants and the improvement of water quality to at least the same extent as the United States does under its laws.

Administration.

"(d) Except as otherwise expressly provided in this Act, the Administrator of the Environmental Protection Agency (hereinafter in this Act called 'Administrator') shall administer this Act.

Regulations.

"(e) Public participation in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator or any State under this Act shall be provided for, encouraged, and assisted by the Administrator and the States. The Administrator, in cooperation with the States, shall develop and publish regulations specifying minimum guidelines for public participation in such processes.

"(f) It is the national policy that to the maximum extent possible the procedures utilized for implementing this Act shall encourage the drastic minimization of paperwork and interagency decision procedures, and the best use of available manpower and funds, so as to prevent needless duplication and unnecessary delays at all levels of government.

"COMPREHENSIVE PROGRAMS FOR WATER POLLUTION CONTROL

"SEC. 102. (a) The Administrator shall, after careful investigation, and in cooperation with other Federal agencies, State water pollution control agencies, interstate agencies, and the municipalities and industries involved, prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for the protection and propagation of fish and aquatic life and wildlife, recreational purposes, and the withdrawal of such waters for public water supply, agricultural, industrial, and other purposes. For the purpose of this section, the Administrator is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may adversely affect such waters.

"(b) (1) In the survey or planning of any reservoir by the Corps of Engineers, Bureau of Reclamation, or other Federal agency, consideration shall be given to inclusion of storage for regulation of streamflow, except that any such storage and water releases shall not be provided as a substitute for adequate treatment or other methods of controlling waste at the source.

"(2) The need for and the value of storage for regulation of streamflow (other than for water quality) including but not limited to navigation, salt water intrusion, recreation, esthetics, and fish and wildlife, shall be determined by the Corps of Engineers, Bureau of Reclamation, or other Federal agencies.

"(3) The need for, the value of, and the impact of, storage for water quality control shall be determined by the Administrator, and his views on these matters shall be set forth in any report or presentation to Congress proposing authorization or construction of any reservoir including such storage.

"(4) The value of such storage shall be taken into account in determining the economic value of the entire project of which it is a part, and costs shall be allocated to the purpose of regulation of streamflow in a manner which will insure that all project purposes, share equitably in the benefits of multiple-purpose construction.

"(5) Costs of regulation of streamflow features incorporated in any Federal reservoir or other impoundment under the provisions of this Act shall be determined and the beneficiaries identified and if the benefits are widespread or national in scope, the costs of such features shall be nonreimbursable.

Report to Congress.

"(c) The Administrator shall report to Congress not later than July 1, 1973, the results of the demonstration projects authorized by this section together with his recommendations, including any necessary legislation, relating to the establishment of a statewide program.

Appropriation.

"(d) There is authorized to be appropriated not to exceed $2,000,000 to carry out this section.

"IN-PLACE TOXIC POLLUTANTS

"Sec. 115. The Administrator is directed to identify the location of in-place pollutants with emphasis on toxic pollutants in harbors and navigable waterways and is authorized, acting through the Secretary of the Army, to make contracts for the removal and appropriate disposal of such materials from critical port and harbor areas. There is authorized to be appropriated $15,000,000 to carry out the provisions of this section, which sum shall be available until expended.

Appropriation.

"TITLE II—GRANTS FOR CONSTRUCTION OF TREATMENT WORKS

"PURPOSE

"Sec. 201. (a) It is the purpose of this title to require and to assist the development and implementation of waste treatment management plans and practices which will achieve the goals of this Act.

"(b) Waste treatment management plans and practices shall provide for the application of the best practicable waste treatment technology before any discharge into receiving waters, including reclaiming and recycling of water, and confined disposal of pollutants so they will not migrate to cause water or other environmental pollution and shall provide for consideration of advanced waste treatment techniques.

"(c) To the extent practicable, waste treatment management shall be on an areawide basis and provide control or treatment of all point and nonpoint sources of pollution, including in place or accumulated pollution sources.

"(d) The Administrator shall encourage waste treatment management which results in the construction of revenue producing facilities providing for—

"(1) the recycling of potential sewage pollutants through the production of agriculture, silviculture, or aquaculture products, or any combination thereof:

"(2) the confined and contained disposal of pollutants not recycled;

"(3) the reclamation of wastewater; and

"(4) the ultimate disposal of sludge in a manner that will not result in environmental hazards.

"(e) The Administrator shall encourage waste treatment management which results in integrating facilities for sewage treatment and recycling with facilities to treat, dispose of, or utilize other industrial and municipal wastes, including but not limited to solid waste and waste heat and thermal discharges. Such integrated facilities shall be designed and operated to produce revenues in excess of capital and operation and maintenance costs and such revenues shall be used by the designated regional management agency to aid in financing other environmental improvement programs.

"(f) The Administrator shall encourage waste treatment management which combines 'open space' and recreational considerations with such management.

"(g)(1) The Administrator is authorized to make grants to any State, municipality, or intermunicipal or interstate agency for the construction of publicly owned treatment works.

"(2) The Administrator shall not make grants from funds authorized for any fiscal year beginning after June 30, 1974, to any State, municipality, or intermunicipal or interstate agency for the erection, building, acquisition, alteration, remodeling, improvement, or extension of treatment works unless the grant applicant has satisfactorily demonstrated to the Administrator that—

Conditions.

"(A) alternative waste management techniques have been studied and evaluated and the works proposed for grant assistance will provide for the application of the best practicable waste treatment technology over the life of the works consistent with the purposes of this title; and

"(B) as appropriate, the works proposed for grant assistance will take into account and allow to the extent practicable the application of technology at a later date which will provide for the reclaiming or recycling of water or otherwise eliminate the discharge of pollutants.

"(3) The Administrator shall not approve any grant after July 1, 1973, for treatment works under this section unless the applicant shows to the satisfaction of the Administrator that each sewer collection system discharging into such treatment works is not subject to excessive infiltration.

"(4) The Administrator is authorized to make grants to applicants for treatment works grants under this section for such sewer system evaluation studies as may be necessary to carry out the requirements of paragraph (3) of this subsection. Such grants shall be made in accordance with rules and regulations promulgated by the Administrator. Initial rules and regulations shall be promulgated under this paragraph not later than 120 days after the date of enactment of the Federal Water Pollution Control Act Amendments of 1972.

Rules and regulations.

"NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Permits, issuance.

"Sec. 402. (a)(1) Except as provided in sections 318 and 404 of this Act, the Administrator may, after opportunity for public hearing, issue a permit for the discharge of any pollutant, or combination of pollutants, notwithstanding section 301(a), upon condition that such discharge will meet either all applicable requirements under sections 301, 302, 306, 307, 308, and 403 of this Act, or prior to the taking of necessary implementing actions relating to all such requirements, such conditions as the Administrator determines are necessary to carry out the provisions of this Act.

"(2) The Administrator shall prescribe conditions for such permits to assure compliance with the requirements of paragraph (1) of this subsection, including conditions on data and information collection, reporting, and such other requirements as he deems appropriate.

"(3) The permit program of the Administrator under paragraph (1) of this subsection, and permits issued thereunder, shall be subject to the same terms, conditions, and requirements as apply to a State permit program and permits issued thereunder under subsection (b) of this section.

"(4) All permits for discharges into the navigable waters issued pursuant to section 13 of the Act of March 3, 1899, shall be deemed to be permits issued under this title, and permits issued under this title shall be deemed to be permits issued under section 13 of the Act of

30 Stat. 1152.
33 USC 407.

March 3, 1899, and shall continue in force and effect for their term unless revoked, modified, or suspended in accordance with the provisions of this Act.

"(5) No permit for a discharge into the navigable waters shall be issued under section 13 of the Act of March 3, 1899, after the date of enactment of this title. Each application for a permit under section 13 of the Act of March 3, 1899, pending on the date of enactment of this Act shall be deemed to be an application for a permit under this section. The Administrator shall authorize a State, which he determines has the capability of administering a permit program which will carry out the objective of this Act, to issue permits for discharges into the navigable waters within the jurisdiction of such State. The Administrator may exercise the authority granted him by the preceding sentence only during the period which begins on the date of enactment of this Act and ends either on the ninetieth day after the date of the first promulgation of guidelines required by section 304 (h)(2) of this Act, or the date of approval by the Administrator of a permit program for such State under subsection (b) of this section, whichever date first occurs, and no such authorization to a State shall extend beyond the last day of such period. Each such permit shall be subject to such conditions as the Administrator determines are necessary to carry out the provisions of this Act. No such permit shall issue if the Administrator objects to such issuance.

State perm programs.

"(b) At any time after the promulgation of the guidelines required by subsection (h)(2) of section 304 of this Act, the Governor of each State desiring to administer its own permit program for discharges into navigable waters within its jurisdiction may submit to the Administrator a full and complete description of the program it proposes to establish and administer under State law or under an interstate compact. In addition, such State shall submit a statement from the attorney general (or the attorney for those State water pollution control agencies which have independent legal counsel), or from the chief legal officer in the case of an interstate agency, that the laws of such State, or the interstate compact, as the case may be, provide adequate authority to carry out the described program. The Administrator shall approve each such submitted program unless he determines that adequate authority does not exist:

Approval conditions.

"(1) To issue permits which—

"(A) apply, and insure compliance with, any applicable requirements of sections 301, 302, 306, 307, and 403;

"(B) are for fixed terms not exceeding five years; and

"(C) can be terminated or modified for cause including, but not limited to, the following:

"(i) violation of any condition of the permit;

"(ii) obtaining a permit by misrepresentation, or failure to disclose fully all relevant facts;

"(iii) change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;

"(D) control the disposal of pollutants into wells;

"(2)(A) To issue permits which apply, and insure compliance with, all applicable requirements of section 308 of this Act, or

"(B) To inspect, monitor, enter, and require reports to at least the same extent as required in section 308 of this Act;

"(3) To insure that the public, and any other State the waters of which may be affected, receive notice of each application for a permit and to provide an opportunity for public hearing before a ruling on each such application;

"(4) To insure that the Administrator receives notice of each application (including a copy thereof) for a permit;

"(5) To insure that any State (other than the permitting State), whose waters may be affected by the issuance of a permit may submit written recommendations to the permitting State (and the Administrator) with respect to any permit application and, if any part of such written recommendations are not accepted by the permitting State, that the permitting State will notify such affected State (and the Administrator) in writing of its failure to so accept such recommendations together with its reasons for so doing;

"(6) To insure that no permit will be issued if, in the judgment of the Secretary of the Army acting through the Chief of Engineers, after consultation with the Secretary of the department in which the Coast Guard is operating, anchorage and navigation of any of the navigable waters would be substantially impaired thereby;

"(7) To abate violations of the permit or the permit program, including civil and criminal penalties and other ways and means of enforcement;

"(8) To insure that any permit for a discharge from a publicly owned treatment works includes conditions to require adequate notice to the permitting agency of (A) new introductions into such works of pollutants from any source which would be a new source as defined in section 306 if such source were discharging pollutants, (B) new introductions of pollutants into such works from a source which would be subject to section 301 if it were discharging such pollutants, or (C) a substantial change in volume or character of pollutants being introduced into such works by a source introducing pollutants into such works at the time of issuance of the permit. Such notice shall include information on the quality and quantity of effluent to be introduced into such treatment works and any anticipated impact of such change in the quantity or quality of effluent to be discharged from such publicly owned treatment works; and

"(9) To insure that any industrial user of any publicly owned treatment works will comply with sections 204(b), 307, and 308.

"(c)(1) Not later than ninety days after the date on which a State has submitted a program (or revision thereof) pursuant to subsection (b) of this section, the Administrator shall suspend the issuance of permits under subsection (a) of this section as to those navigable waters subject to such program unless he determines that the State permit program does not meet the requirements of subsection (b) of this section or does not conform to the guidelines issued under section 304(h)(2) of this Act. If the Administrator so determines, he shall notify the State of any revisions or modifications necessary to conform to such requirements or guidelines.

"(2) Any State permit program under this section shall at all times be in accordance with this section and guidelines promulgated pursuant to section 304(h)(2) of this Act.

State permit program, approval withdrawal.

"(3) Whenever the Administrator determines after public hearing that a State is not administering a program approved under this section in accordance with requirements of this section, he shall so notify the State and, if appropriate corrective action is not taken within a reasonable time, not to exceed ninety days, the Administrator shall withdraw approval of such program. The Administrator shall not withdraw approval of any such program unless he shall first have notified the State, and made public, in writing, the reasons for such withdrawal.

Administrator, notification.

"(d)(1) Each State shall transmit to the Administrator a copy of each permit application received by such State and provide notice to the Administrator of every action related to the consideration of such permit application, including each permit proposed to be issued by such State.

"(2) No permit shall issue (A) if the Administrator within ninety days of the date of his notification under subsection (b)(5) of this section objects in writing to the issuance of such permit, or (B) if the Administrator within ninety days of the date of transmittal of the proposed permit by the State objects in writing to the issuance of such permit as being outside the guidelines and requirements of this Act.

Waiver authority.

"(3) The Administrator may, as to any permit application, waive paragraph (2) of this subsection.

"(e) In accordance with guidelines promulgated pursuant to subsection (h)(2) of section 304 of this Act, the Administrator is authorized to waive the requirements of subsection (d) of this section at the time he approves a program pursuant to subsection (b) of this section for any category (including any class, type, or size within such category) of point sources within the State submitting such program.

Point sources, categories.

"(f) The Administrator shall promulgate regulations establishing categories of point sources which he determines shall not be subject to the requirements of subsection (d) of this section in any State with a program approved pursuant to subsection (b) of this section. The Administrator may distinguish among classes, types, and sizes within any category of point sources.

"(g) Any permit issued under this section for the discharge of pollutants into the navigable waters from a vessel or other floating craft shall be subject to any applicable regulations promulgated by the Secretary of the department in which the Coast Guard is operating, establishing specifications for safe transportation, handling, carriage, storage, and stowage of pollutants.

"(h) In the event any condition of a permit for discharges from a treatment works (as defined in section 212 of this Act) which is publicly owned is violated, a State with a program approved under subsection (b) of this section or the Administrator, where no State program is approved, may proceed in a court of competent jurisdiction to restrict or prohibit the introduction of any pollutant into such treatment works by a source not utilizing such treatment works prior to the finding that such condition was violated.

"(i) Nothing in this section shall be construed to limit the authority of the Administrator to take action pursuant to section 309 of this Act.

Public information.

"(j) A copy of each permit application and each permit issued under this section shall be available to the public. Such permit application or permit, or portion thereof, shall further be available on request for the purpose of reproduction.

"(k) Compliance with a permit issued pursuant to this section shall be deemed compliance, for purposes of sections 309 and 505, with sections 301, 302, 306, 307, and 403, except any standard imposed under section 307 for a toxic pollutant injurious to human health. Until December 31, 1974, in any case where a permit for discharge has been applied for pursuant to this section, but final administrative disposition of such application has not been made, such discharge shall not be a violation of (1) section 301, 306, or 402 of this Act, or (2) section 13 of the Act of March 3, 1899, unless the Administrator or other plaintiff proves that final administrative disposition of such application has not been made because of the failure of the applicant to furnish information reasonably required or requested in order to process the application. For the 180-day period beginning on the date of enactment of the Federal Water Pollution Control Act Amendments of 1972, in the case of any point source discharging any pollutant or combination of pollutants immediately prior to such date of enactment which source is not subject to section 13 of the Act of March 3, 1899, the discharge by such source shall not be a violation of this Act if such a source applies for a permit for discharge pursuant to this section within such 180-day period.

30 Stat. 1152.
33 USC 407.

Ante, p. 816.

"OCEAN DISCHARGE CRITERIA

"Sec. 403. (a) No permit under section 402 of this Act for a discharge into the territorial sea, the waters of the contiguous zone, or the oceans shall be issued, after promulgation of guidelines established under subsection (c) of this section, except in compliance with such guidelines. Prior to the promulgation of such guidelines, a permit may be issued under such section 402 if the Administrator determines it to be in the public interest.

"(b) The requirements of subsection (d) of section 402 of this Act may not be waived in the case of permits for discharges into the territorial sea.

Guidelines.

"(c)(1) The Administrator shall, within one hundred and eighty days after enactment of this Act (and from time to time thereafter), promulgate guidelines for determining the degradation of the waters of the territorial seas, the contiguous zone, and the oceans, which shall include:

"(A) the effect of disposal of pollutants on human health or welfare, including but not limited to plankton, fish, shellfish, wildlife, shorelines, and beaches;

"(B) the effect of disposal of pollutants on marine life including the transfer, concentration, and dispersal of pollutants or their byproducts through biological, physical, and chemical processes; changes in marine ecosystem diversity, productivity, and stability; and species and community population changes;

"(C) the effect of disposal, of pollutants on esthetic, recreation, and economic values;

"(D) the persistence and permanence of the effects of disposal of pollutants;

"(E) the effect of the disposal at varying rates, of particular volumes and concentrations of pollutants;

"(F) other possible locations and methods of disposal or recycling of pollutants including land-based alternatives, and

"(G) the effect on alternate uses of the oceans, such as mineral exploitation and scientific study.

"(2) In any event where insufficient information exists on any proposed discharge to make a reasonable judgment on any of the guidelines established pursuant to this subsection no permit shall be issued under section 402 of this Act. Prohibition.

"PERMITS FOR DREDGED OR FILL MATERIAL

"Sec. 404. (a) The Secretary of the Army, acting through the Chief of Engineers, may issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at specified disposal sites. Notice, hearing opportunity.

"(b) Subject to subsection (c) of this section, each such disposal site shall be specified for each such permit by the Secretary of the Army (1) through the application of guidelines developed by the Administrator, in conjunction with the Secretary of the Army, which guidelines shall be based upon criteria comparable to the criteria applicable to the territorial seas, the contiguous zone, and the ocean under section 403(c), and (2) in any case where such guidelines under clause (1) alone would prohibit the specification of a site, through the application additionally of the economic impact of the site on navigation and anchorage.

"(c) The Administrator is authorized to prohibit the specification (including the withdrawal of specification) of any defined area as a disposal site, and he is authorized to deny or restrict the use of any defined area for specification (including the withdrawal of specification) as a disposal site, whenever he determines, after notice and opportunity for public hearings, that the discharge of such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas. Before making such determination, the Administrator shall consult with the Secretary of the Army. The Administrator shall set forth in writing and make public his findings and his reasons for making any determination under this subsection. Disposal site, specification prohibition. Findings of Administrator, publication.

WATER QUALITY CONTROL PLAN

Ocean Waters of California

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

State of California
The Resources Agency

STATE WATER RESOURCES CONTROL BOARD

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WATER QUALITY CONTROL PLAN
FOR
OCEAN WATERS OF CALIFORNIA

Adopted and Effective
July 6, 1972

STATE OF CALIFORNIA

Ronald Reagan, Governor

The Resources Agency

STATE WATER RESOURCES CONTROL BOARD

W. W. Adams, Chairman
Edward F. Dibble, Vice Chairman
Ronald B. Robie, Member
Roy E. Dodson, Member
Mrs. Carl H. (Jean) Auer, Member

Bill B. Dendy, Executive Officer

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STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 72-45

WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA

WHEREAS:

1. The Board finds it necessary to promulgate water quality objectives and effluent quality requirements to govern the disposal of waste into the coastal waters of California;

2. The Board, after extensive review and analysis of testimony received at public hearings, has determined that protection of beneficial uses of the ocean waters of the State will require maximum practicable control of waste substances which may unreasonably impair those uses;

3. The Board finds that maximum practicable control of waste can be achieved through a comprehensive program which combines source control of waste and modern waste treatment technology;

4. The Board believes that application of current technology through intelligent design of control systems rather than irrational specification of arbitrary treatment methods can provide the highest degree of water quality protection without unreasonable cost;

5. The Board intends to implement monitoring programs to determine compliance with water quality objectives and effluent quality requirements, and to yield other information such as the effectiveness of source control programs and the identification of any short-term or long-term degradation of marine biota;

6. The Board intends to review all available data from time to time to determine the efficacy of control programs for protecting water quality;

THEREFORE, BE IT RESOLVED, that

1. The Board hereby adopts the "WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA"

2. The Board hereby directs all affected California Regional Water Quality Control Boards to implement the provisions of the PLAN.

3. The Board hereby directs its Executive Officer to issue guidelines for monitoring the effects of waste discharges to the ocean at the earliest possible date.

4. The Board hereby declares its intent to determine from time to time the need for revising the PLAN to assure that it reflects current knowledge of water quality objectives necessary to protect beneficial uses of ocean waters and that it is based on latest technological improvements.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on July 6, 1972.

Bill B. Dendy

Bill B. Dendy
Executive Officer

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA

In furtherance of legislative policy set forth in Section 13000 of Division 7 of the California Water Code (Stats. 1969, Chap. 482) and pursuant to the authority contained in Section 13170 (Stats. 1971, Chap. 1288) the State Water Resources Control Board hereby finds and declares that protection of the quality of the ocean waters for use and enjoyment by the people of the State requires control of the discharge of waste[1] to ocean waters[2] in accordance with the provisions contained herein.

CHAPTER I.
BENEFICIAL USES

The beneficial uses of the ocean waters of the State that shall be protected include industrial water supply, recreation, esthetic enjoyment, navigation, and preservation and enhancement of fish, wildlife, and other marine resources or preserves.

CHAPTER II.
WATER QUALITY OBJECTIVES

This chapter sets forth limits or levels of water quality characteristics for ocean waters to ensure the reasonable protection of beneficial uses and the prevention of nuisance. The discharge of waste shall not cause violation of these objectives.[3]

A. Bacteriological Characteristics

1. Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas[4] outside this zone used for body-contact sports, the following bacteriological objectives shall be maintained throughout the water column:

   > Samples of water from each sampling station shall have a most probable number of coliform organisms less than 1,000 per 100 ml (10 per ml); provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml (10 per ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml (100 per ml).

Adopted by the State Water Resources Control Board by Resolution No. 72-45 on July 6, 1972.

2. At all areas[4] where shellfish may be harvested for human consumption, the following bacteriological objectives shall be maintained throughout the water column:

   > The median total coliform concentration shall not exceed 70 per 100 ml, and not more than 10 percent of the samples shall exceed 230 per 100 ml.

B. Physical Characteristics

1. Floating particulates and grease and oil shall not be visible.
2. The concentration of grease and oil (hexane extractables) on the water surface shall not exceed 10 mg/m^2 more than 50 percent of the time, nor 20 mg/m^2 more than 10 percent of the time.[5]
3. The concentration of floating particulates of waste origin on the water surface shall not exceed 1.0 mg dry weight/m^2 more than 50 percent of the time, nor 1.5 mg dry weight/m^2 more than 10 percent of the time.[5]
4. The discharge of waste shall not cause esthetically undesirable discoloration of the ocean surface.
5. The transmittance of natural light shall not be significantly[6] reduced at any point outside the initial dilution zone.[7]
6. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.[8]

C. Chemical Characteristics

1. The dissolved oxygen concentration[9] shall not at any time be depressed more than 10 percent from that which occurs naturally.
2. The pH[9] shall not be changed at any time more than 0.2 units from that which occurs naturally.

3. The dissolved sulfide concentration of waters in and near sediments shall not be significantly[9] increased above that present under natural conditions.

4. The concentration of substances set forth in Chapter IV, Table B, in marine sediments shall not be significantly[9] increased above that present under natural conditions.

5. The concentration of organic materials in marine sediments shall not be increased above that which would degrade[8] marine life.

6. Nutrient materials shall not cause objectionable aquatic growths or degrade[8] indigenous biota.

D. Biological Characteristics

1. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.[8]

2. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.

E. Toxicity Characteristics

1. The final toxicity concentration shall not exceed 0.05 toxicity units.[10]

F. Radioactivity

1. Radioactivity shall not exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California Administrative Code.

CHAPTER III.
PRINCIPLES FOR MANAGEMENT OF WASTE DISCHARGES TO THE OCEAN

A. Waste management systems that discharge to the ocean must be designed and operated in a manner that will maintain the indigenous marine life and a healthy and diverse marine community.

B. Waste discharged to the ocean must be essentially free[11] of:

   1. material that is floatable or will become floatable upon discharge,

   2. settleable material or substances that form sediments which degrade[8] benthic communities or other aquatic life,

   3. substances toxic to marine life due to increases in concentrations in marine waters or sediments,

   4. substances that significantly decrease the natural light to benthic communities and other marine life, and

   5. materials that result in esthetically undesirable discoloration of the ocean surface.

C. Ocean outfalls and diffusion systems must be designed to achieve rapid initial dilution[12] and effective dispersion to minimize concentrations of substances not removed by treatment.

D. Location of waste discharges must be determined after a detailed assessment of the oceanographic characteristics and current patterns to assure that:

   1. pathogenic organisms and viruses are not present in areas where shellfish are harvested for human consumption or in areas used for swimming or other body-contact sports,[13]

2. natural water quality conditions are not altered in areas designated as being of special biological significance, and

3. maximum protection is provided to the marine environment.

CHAPTER IV.
QUALITY REQUIREMENTS FOR WASTE DISCHARGES (EFFLUENT QUALITY REQUIREMENTS)

This chapter sets forth the quality requirements for waste discharges to the ocean.[3]

TABLE A

	Unit of measurement	Concentration not to be exceeded more than: 50% of time	10% of time
Grease and Oil (hexane extractables)	mg/l	10.	15.
Floating Particulates (dry weight)	mg/l	1.0	2.0
Suspended Solids	mg/l	50.	75.
Settleable Solids	ml/l	0.1	0.2
Turbidity	JTU	50.	75.
pH	units	within limits of 6.0 to 9.0 at all times.	

TABLE B

	Unit of measurement	Concentration not to be exceeded more than: 50% of time	10% of time
Arsenic	mg/l	0.01	0.02
Cadmium	mg/l	0.02	0.03
Total Chromium	mg/l	0.005	0.01
Copper	mg/l	0.2	0.3
Lead	mg/l	0.1	0.2
Mercury	mg/l	0.001	0.002
Nickel	mg/l	0.1	0.2
Silver	mg/l	0.02	0.04
Zinc	mg/l	0.3	0.5
Cyanide	mg/l	0.1	0.2
Phenolic Compounds	mg/l	0.5	1.0
Total Chlorine Residual	mg/l	1.0	2.0
Ammonia (expressed as nitrogen)	mg/l	40.	60.
Total Identifiable Chlorinated Hydrocarbons[14]	mg/l	0.002	0.004
Toxicity Concentration[10]	tu	1.5	2.0
Radioactivity		not to exceed the limit specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 5, Section 30285 and 30287 of the California Administrative Code.	

CHAPTER V.
DISCHARGE PROHIBITIONS

A. Hazardous Substances

The discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste into the ocean is prohibited.

B. Areas of Special Biological Significance

Waste shall be discharged a sufficient distance from areas designated as being of special biological significance to assure maintenance of natural water quality conditions in these areas.

C. Sludge

The discharge of municipal and industrial waste sludge and sludge digester supernatant directly to the ocean, or into a waste stream that discharges to the ocean without further treatment, shall be prohibited.

D. By-Passing

The by-passing of untreated waste to the ocean shall be prohibited.

CHAPTER VI.
GENERAL PROVISIONS

A. Effective Date

This plan is in effect as of the date of adoption by the State Water Resources Control Board. The less restrictive provisions of each of the extant policies and plans for the ocean shall be void and superseded by all applicable provisions of this plan.

B. Mass Emission Rates

In addition to receiving water objectives and effluent quality requirements, waste discharge requirements shall set forth the Maximum Allowable Daily Mass Emission Rate and the Maximum Allowable Monthly Mass Emission Rate for each effluent quality constituent included in the waste discharge requirements.

The Maximum Allowable Daily Mass Emission Rate for each constituent shall be calculated from the total waste flow occurring each specific day and the concentration specified in waste discharge requirements as that not to be exceeded more than 10 percent of the time. The mass emission rate of the discharge during any 24-hour period shall not exceed the Maximum Allowable Daily Mass Emission Rate.

The Maximum Allowable Monthly Mass Emission Rate for each constituent shall be calculated from the total waste flow occurring in each specific month and the concentration specified in waste discharge requirements as that not to be exceeded more than 50 percent of the time. The mass emission rate of the discharge during any monthly period shall not exceed the Maximum Allowable Monthly Mass Emission Rate.

C. Technical Reports

Persons responsible for existing waste discharges to the ocean shall be required by the Regional Board to submit a technical report prior to January 15, 1973. The technical report shall include but not be limited to:

1. A proposed program of improvement of waste treatment facilities necessary to assure compliance with all provisions of this plan.
2. A proposed time schedule for construction of necessary facilities.
3. An estimate of the capital cost of necessary facilities.
4. Any request, with supporting evidence, for less restrictive effluent quality requirements.
5. An analysis of all other factors deemed necessary by the Regional Board to permit establishment of waste discharge requirements.

For discharges exceeding 40 mgd the technical report shall include a correlation of the effluent quality requirements for the parameters set forth in Chapter IV, Table A, with all water quality objectives set forth in Chapter II, and with all effluent quality requirements set forth in Chapter IV, Table B.

D. Waste Discharge Requirements

The Regional Boards may establish more restrictive water quality objectives and effluent quality requirements than those set forth in this plan as necessary for the protection of beneficial uses of the ocean.

Effluent quality requirements shall not be less restrictive than those set forth in Chapter IV, Table B, of this plan.

Effluent quality requirements may be less restrictive than those set forth in Chapter IV, Table A, of this plan provided the Regional Board finds that the discharge shall comply with all water quality objectives set forth in Chapter II and all effluent quality requirements set forth in Chapter IV, Table B. Less restrictive effluent quality requirements shall be effective only upon approval by the State Board.

E. Revision of Waste Discharge Requirements

The Regional Board shall revise the waste discharge requirements for existing discharges as necessary to achieve compliance with this plan and shall also establish a time schedule for compliance. Prior to adoption, but not later than April 15, 1973, the Regional Board shall submit to the State Board all technical reports provided by the waste dischargers, proposed waste discharge requirements, and time schedules for compliance for all discharges to the ocean.

F. State Board Review of Time Schedules

The State Board shall review proposed time schedules for all municipal discharges throughout the State and shall recommend to the Regional Boards specific schedules to assure the maximum benefit from, and equitable distribution of, available state and federal grant funds.

G. Monitoring Program

The Regional Board shall require dischargers to conduct self-monitoring programs and submit reports necessary to determine compliance with the waste discharge requirements, and may require dischargers to contract with agencies or persons acceptable to the Regional Board to provide monitoring reports. Such monitoring programs shall comply with Guidelines for Monitoring the Effects of Waste Discharges on the Ocean which shall be issued by the Executive Officer of the State Board.

H. Areas of Special Biological Significance

Areas of special biological significance shall be designated by the State Board after a public hearing by the Regional Board and review of its recommendations.

FOOTNOTES

1/ This plan is not applicable to vessel wastes, the control of dredging, or the disposal of dredging spoil. Provisions regulating the thermal aspects of waste discharged to the ocean are set forth in the Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California dated May 18, 1972.

2/ Ocean waters are waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons.

Enclosed bays are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Carmel Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

Estuaries and coastal lagoons are waters at the mouths of streams which serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

3/ The Water Quality Objectives and Effluent Quality Requirements are defined by a statistical distribution when appropriate. This method recognizes the normally occurring variations in treatment efficiency and sampling and analytical techniques and does not condone poor operating practices. The 50 percentile value (concentration not to be exceeded more than 50 percent of the time) and 90 percentile value (concentration not to be exceeded more than 10 percent of the time) establish an acceptable distribution for any consecutive 30-day period. The distribution of actual sampling data for any consecutive 30-day period shall not have any percentile value exceeding that of the acceptable distribution.

4/ Body-contact sports areas outside the shoreline zone set forth in Chapter II. A.1. and all shellfishing areas shall be determined by the Regional Board on an individual basis.

5/ Surface samples shall be collected from stations representative of the area of maximum probable impact.

6/ The mean of sampling results for any consecutive 30-day period must be within one (1) standard deviation of the mean determined for natural levels for the same period.

7/ Initial Dilution Zone is the volume of water near the point of discharge within which the waste immediately mixes with ocean water due to the momentum of the waste discharge and the difference in density between the waste and the receiving water.

8/ Degradation shall be determined by analysis of the effects of waste discharge on species diversity, population density, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species.

9/ Compliance with water quality objectives shall be determined from samples collected at stations representative of the area within the waste field where initial dilution is completed. The 10 percent depression of dissolved oxygen may be determined after allowance for effects of induced upwelling.

10/ This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

a. Toxicity Concentration (Tc)

Expressed in Toxicity Units (tu)

$$\text{Tc (tu)} = \frac{100}{\text{96-hr. TLm\%}}$$

b. Median Tolerance Limit (TLm%)

The TLm shall be determined by static or continuous flow bioassay techniques using standard test species. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, the TLm may be determined after the test samples are adjusted to remove the influence of those substances.

When it is not possible to measure the 96-hr. TLm due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

$$\text{Tc (tu)} = \frac{\log (100 - S)}{1.7}$$

S = percentage survival in 100% waste.

c. Toxicity Emission Rate (TER)

Is the product of the effluent Toxicity Concentration (Tc) and the waste flow rate expressed as mgd.

$$\text{TER (tu·mgd)} = \text{Tc (tu)} \times \text{Waste Flow Rate (mgd)}$$

d. Final Toxicity Concentration

(FTc) expressed in toxicity units (tu) shall be determined by a bioassay and estimated by the following calculations:

$$\text{FTc (tu)} = \frac{\text{Toxicity Emission Rate}}{\text{Initial Dilution Water + Waste Flow}}$$

$$= \frac{\text{TER}}{\text{Qd + Qw}}$$

e. Initial Dilution Water (Qd)

Shall be calculated as the product of estimated current velocity, effective diffuser length normal to the prevailing current, and effective mixing depth.

11/ Essentially free means the specific limitations set forth in Chapter IV of this plan.

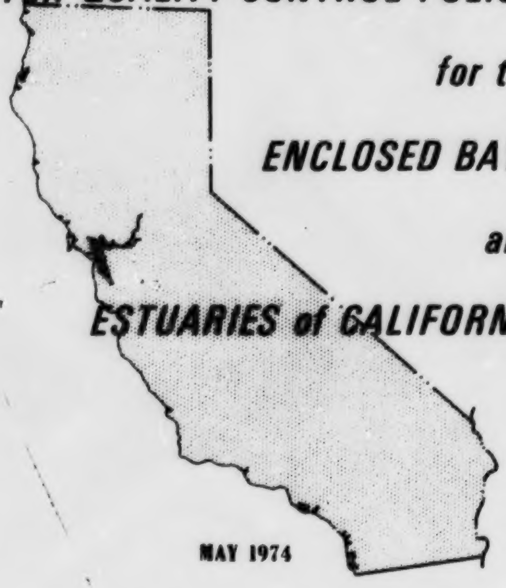
12/ Diffusion systems should provide an initial dilution of wastewater with seawater exceeding 100 to 1 at least 50 percent of the time, and exceeding 80 to 1 at least 90 percent of the time. If a waste is essentially identical to natural seawater, less restrictive dilution requirements may be permitted by the Regional Board.

13/ Waste that contains pathogenic organisms or viruses should be discharged a sufficient distance from shellfishing and body-contact sports areas to maintain applicable bacteriological standards without disinfection. Where conditions are such that an adequate distance cannot be attained, reliable disinfection in conjunction with a reasonable separation of the discharge point from the area of use must be provided. Consideration should be given to disinfection procedures that do not increase effluent toxicity and that constitute the least environmental and human hazard in their production, transport, and utilization.

14/ Total Identifiable Chlorinated Hydrocarbons shall be measured by summing the individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

State of California The Resources Agency

WATER QUALITY CONTROL POLICY for the ENCLOSED BAYS and ESTUARIES of CALIFORNIA



MAY 1974

STATE WATER RESOURCES CONTROL BOARD

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APPENDIX A

Analysis of Testimony and Written Comments to the State Board*

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* To be furnished upon request.

WATER QUALITY CONTROL POLICY FOR THE ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA[1]

INTRODUCTION

The purpose of this policy is to provide water quality principles and guidelines to prevent water quality degradation and to protect the beneficial uses of waters of enclosed bays and estuaries. Decisions on water quality control plans, waste discharge requirements, construction grant projects, water rights permits, and other specific water quality control implementing actions of the State and Regional Boards shall be consistent with the provisions of this policy.

The Board declares its intent to determine from time to time the need for revising this policy.

This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation (Chapter III 4.) and combined sewer flows (Chapter III 7.).

CHAPTER I.

PRINCIPLES FOR MANAGEMENT OF WATER QUALITY IN ENCLOSED BAYS AND ESTUARIES

A. It is the policy of the State Board that the discharge of municipal wastewaters and industrial process waters[2] (exclusive of cooling water discharges) to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, shall be phased out at the earliest practicable date. Exceptions to this provision may be granted by a Regional Board only when the Regional Board finds that the wastewater in question would consistently be treated and discharged in such a manner that it would enhance the quality of receiving waters above that which would occur in the absence of the discharge. [3]

B. With regard to the waters of the San Francisco Bay-Delta system, the State Board finds and directs as follows:

   1a. There is a considerable body of scientific evidence and opinion which suggests the existence of biological degradation due to long-term exposure to toxicants which have been discharged to the San Francisco Bay-Delta system. Therefore, implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded wastewater treatment, and improved dilution of wastewaters, shall proceed as rapidly as is practicable with the objective of providing full protection to the biota and the beneficial uses of Bay-Delta waters in a cost-effective manner.

1b. A comprehensive understanding of the biological effects of wastewater discharge on San Francisco Bay, as a whole, must await the results of further scientific study. There is, however, sufficient evidence at this time to indicate that the continuation of wastewater discharges to the southern reach of San Francisco Bay, south of the Dumbarton Bridge, is an unacceptable condition. The State Board and the San Francisco Regional Board shall take such action as is necessary to assure the elimination of wastewater discharges to waters of the San Francisco Bay, south of Dumbarton Bridge, at the earliest practicable date.

1c. In order to prevent excessive investment which would unduly impact the limited funds available to California for construction of publicly owned treatment works, construction of such works shall proceed in a staged fashion, and each stage shall be fully evaluated by the State and Regional Boards to determine the necessity for additional expenditures. Monitoring requirements shall be established to evaluate any effects on water quality, particularly changes in species diversity and abundance, which may result from the operation of each stage of planned facilities and source control programs. Such a staged construction program, in combination with an increased monitoring effort, will result in the most cost-effective and rapid progress toward a goal of maintaining and enhancing water quality in the San Francisco Bay-Delta system.

2. Where a waste discharger has an alternative of in-bay or ocean disposal and where both alternatives offer a similar degree of environmental and public health protection, prime consideration shall be given to the alternative which offers the greater degree of flexibility for the implementation of economically feasible wastewater reclamation options.

C. The following policies apply to all of California's enclosed bays and estuaries:

1. Persistent or cumulative toxic substances shall be removed from the waste to the maximum extent practicable through source control or adequate treatment prior to discharge.
2. Bay or estuarine outfall and diffuser systems shall be designed to achieve the most rapid initial dilution[4/] practicable to minimize concentrations of substances not removed by source control or treatment.
3. Wastes shall not be discharged into or adjacent to areas where the protection of beneficial uses requires spatial separation from waste fields.
4. Waste discharges shall not cause a blockage of zones of passage required for the migration of anadromous fish.
5. Nonpoint sources of pollutants shall be controlled to the maximum practicable extent.

CHAPTER II.

QUALITY REQUIREMENTS FOR WASTE DISCHARGES

1. In addition to any requirements of this policy, effluent limitations shall be as specified pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Control Act, and Regional Boards shall limit the mass emissions of substances as necessary to meet such limitations. Regional Boards may set more restrictive mass emission rates and concentration standards than those which are referenced in this policy to reflect dissimilar tolerances to wastewater constituents among different receiving water bodies.
2. All dischargers of thermal wastes or elevated temperature wastes to enclosed bays and estuaries which are permitted pursuant to this policy shall comply with the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of Califonia", State Water Resources Control Board, 1972, and with amendments and supplements thereto.
3. Radiological limits for waste discharges (for which regulatory responsibility is not preempted by the Federal Government) shall be at least as restrictive as limitations indicated in Section 30269, and Section 30355, Appendix A, Table II, of the California Administrative Code.
4. Dredge spoils to be disposed of in bay and estuarine waters must comply with federal criteria for determining the acceptability of dredged spoils to marine water*, and must be certified by the State Board or Regional Boards as in compliance with State Plans and Policies.

CHAPTER III.

DISCHARGE PROHIBITIONS

1. New discharges[5] of municipal wastewaters and industrial process waters[2] (exclusive of cooling water discharges) to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, which are not consistently treated and discharged in a manner that would enhance the quality of receiving waters above that which would occur in the absence of the discharge, shall be prohibited.
2. The discharge of municipal and industrial waste sludge and untreated sludge digester supernatant, centrate, or filtrate to enclosed bays and estuaries shall be prohibited.
3. The deposition of rubbish or refuse into surface waters or at any place where they would be eventually transported to enclosed bays or estuaries shall be prohibited.[6]
4. The direct or indirect discharge of silt, sand, soil clay, or other earthen materials from onshore operations including mining, construction, agriculture, and lumbering, in quantities which unreasonably affect or threaten to affect beneficial uses shall be prohibited.
5. The discharge of materials of petroleum origin in sufficient quantities to be visible or in violation of waste discharge requirements shall be prohibited, except when such discharges are conducted for scientific purposes. Such testing must be approved by the Executive Officer of the Regional Board and the Department of Fish and Game.
6. The discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste shall be prohibited.
7. The discharge or by-passing of untreated waste to bays and estuaries shall be prohibited.[7]

CHAPTER IV.

GENERAL PROVISIONS

A. Effective Date

This policy is in effect as of the date of adoption by the State Water Resources Control Board.

B. Review and Revision of Plans, Policies and Waste Discharge Requirements

Provisions of existing or proposed policies or water quality control plans adopted by the State or Regional Boards for enclosed bays or estuaries shall be amended to conform with the applicable provisions of this policy.

Each appropriate Regional Board shall review and revise the waste discharge requirements with appropriate time schedules for existing discharges to achieve compliance with this policy and applicable water quality objectives. Each Regional Board affected by this policy shall set forth for each discharge allowable mass emission rates for each applicable effluent characteristic included in waste discharge requirements.

Regional Boards shall finalize waste discharge requirements as rapidly as is consistent with the National Pollutant Discharge Elimination System Permit Program.

C. **Administration of Clean Water Grants Program**

The Clean Water Grants Program shall require that the environmental impact report for any existing or proposed wastewater discharge to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, shall evaluate whether or not the discharge would enhance the quality of receiving waters above that which would occur in the absence of the discharge.

The Clean Water Grants Program shall require that each study plan and project report (beginning with F. Y. 1974-75 projects) for a proposed wastewater treatment or conveyance facility within the San Francisco Bay-Delta system shall contain an evaluation of the degree to which the proposed project represents a necessary and cost-effective stage in a program leading to compliance with an objective of full protection of the biota and beneficial uses of Bay-Delta waters.

D. **Administration of Water Rights**

Any applicant for a permit to appropriate from a watercourse which is tributary to an enclosed bay or estuary may be required to present to the State Board an analysis of the anticipated effects of the proposed appropriation on water quality and beneficial uses of the effected bay or estuary.

E. **Monitoring Program**

The Regional Board shall require dischargers to conduct self-monitoring programs and submit reports as necessary to determine compliance with waste discharge requirements and to evaluate the effectiveness of wastewater control programs. Such monitoring programs shall comply with applicable sections of the State Board's Administrative Procedures, and any additional guidelines which may be issued by the Executive Officer of the State Board.

FOOTNOTES

1/ Enclosed bays are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outer most harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes, but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

Estuaries, including coastal lagoons, are waters at the mouths of streams which serve as mixing zones for fresh and ocean waters.
Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters shall be considered to extend seaward if significant mixing of fresh and saltwater occurs in the open coastal waters. Estuarine waters include, but are not limited to, the Sacramento-San Joaquin Delta, as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

2/ For the purpose of this policy, treated ballast waters and innocuous nonmunicipal wastewater such as clear brines, washwater, and pool drains are not necessarily considered industrial process wastes, and may be allowed by Regional Boards under discharge requirements that provide protection to the beneficial uses of the receiving water.

3/ Undiluted wastewaters covered under this exception provision shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time of a standard test species in a 96-hour static or continuous flow bioassay test using undiluted waste. Maintenance of these levels of survival shall not by themselves constitute sufficient evidence that the discharge satisfies the criteria of enhancing the quality of the receiving water above that which occur in the absence of the discharge. Full and uninterrupted protection for the beneficial uses of the receiving water must be maintained. A Regional Board may require physical, chemical, bioassay, and bacteriological assessment of treated wastewater quality prior to authorizing release to the bay or estuary of concern.

4/ Initial dilution zone is defined as the volume of water near the point of discharge within which the waste immediately mixes with the bay or estuarine water due to the momentum of the waste discharge and the difference in density between the waste and receiving water.

5/ A new discharge is a discharge for which a Regional Board has not received a report of waste discharge prior to the date of adoption of this policy, and which was not in existence prior to the date of adoption of this policy.

6/ Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals or dead fish deposited or caused to be deposited by man.

7/ The prohibition does not apply to cooling water streams which comply with the "Water Quality Control Plan for the Control of Temperature in Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" - State Water Resources Control Board.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 74-43

WATER QUALITY CONTROL POLICY FOR THE ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA

WHEREAS:

1. The Board finds it necessary to promulgate water quality principles, guidelines, effluent quality requirements, and prohibitions to govern the disposal of waste into the enclosed bays and estuaries of California;

2. The Board, after review and analysis of testimony received at public hearings, has determined that it is both feasible and desirable to require that the discharge of municipal wastewaters and industrial process waters to enclosed bays and estuaries (other than the San Francisco Bay-Delta system) should only be allowed when a discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge;

3. The Board has previously promulgated requirements for the discharge of thermal and elevated temperature wastes to enclosed bays and estuaries (Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California - SWRCB, 1972)

4. The Board, after review and analysis of testimony received at public hearings, has determined that implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded waste treatment, and improved dilution of wastewaters, will result in timely and cost-effective progress toward an objective of providing full protection to the biota and beneficial uses of San Francisco Bay-Delta waters;

5. The Board intends to implement monitoring programs to determine the effects of source control programs, upgraded treatment, and improved dispersion of wastewaters on the condition of the biota and beneficial uses of San Francisco Bay-Delta waters.

THEREFORE, BE IT RESOLVED, that

1. The Board hereby adopts the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California".

2. The Board hereby directs all affected California Regional Water Quality Control Boards to implement the provisions of the policy.

3. The Board hereby declares its intent to determine from time to time the need for revising the policy to assure that it reflects current knowledge of water quality objectives necessary to protect beneficial uses of bay and estuarine waters and that it is based on latest technological improvements.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 16, 1974.

Bill B. Dendy

Bill B. Dendy
Executive Officer

WASTEWATER RECLAMATION CRITERIA

An Excerpt from the

CALIFORNIA ADMINISTRATIVE CODE
TITLE 22, DIVISION 4

ENVIRONMENTAL HEALTH

1975

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH
Water Sanitation Section
2151 Berkeley Way, Berkeley 94704

INTENT OF REGULATIONS

The intent of these regulations is to establish acceptable levels of constituents of reclaimed water and to prescribe means for assurance of reliability in the production of reclaimed water in order to ensure that the use of reclaimed water for the specified purposes does not impose undue risks to health. The levels of constituents in combination with the means for assurance of reliability constitute reclamation criteria as defined in Section 13520 of the California Water Code.

As affirmed in Sections 13510 to 13512 of the California Water Code, water reclamation is in the best public interest and the policy of the State is to encourage reclamation. The reclamation criteria are intended to promote development of facilities which will assist in meeting water requirements of the State while assuring positive health protection. Appropriate surveillance and control of treatment facilities, distribution systems, and use areas must be provided in order to avoid health hazards. Precautions must be taken to avoid direct public contact with reclaimed waters which do not meet the standards specified in Article 5 for nonrestricted recreational impoundments.

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CHAPTER 4. RECLAMATION CRITERIA

Article 1. Definitions

60301. Definitions. (a) **Reclaimed Water.** Reclaimed water means water which, as a result of treatment of domestic wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

(b) **Reclamation Plant.** Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

(c) **Regulatory Agency.** Regulatory agency means the California Regional Water Quality Control Board in whose jurisdiction the reclamation plant is located.

(d) **Direct Beneficial Use.** Direct beneficial use means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.

(e) **Food Crops.** Food crops mean any crops intended for human consumption.

(f) **Spray Irrigation.** Spray irrigation means application of reclaimed water to crops by spraying it from orifices in piping.

(g) **Surface Irrigation.** Surface irrigation means application of reclaimed water by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

(h) **Restricted Recreational Impoundment.** A restricted recreational impoundment is a body of reclaimed water in which recreation is limited to fishing, boating, and other non-body-contact water recreation activities.

(i) **Nonrestricted Recreational Impoundment.** A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body-contact water sport activities.

(j) **Landscape Impoundment.** A landscape impoundment is a body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

(k) **Approved Laboratory Methods.** Approved laboratory methods are those specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater", prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and which are conducted in laboratories approved by the State Department of Health

(l) **Unit Process.** Unit process means an individual stage in the wastewater treatment sequence which performs a major single treatment operation

(m) **Primary Effluent.** Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method

(n) **Oxidized Wastewater.** Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

(o) **Biological Treatment.** Biological treatment means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

(p) **Secondary Sedimentation.** Secondary sedimentation means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.

(q) **Coagulated Wastewater.** Coagulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

(r) **Filtered Wastewater.** Filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

(s) **Disinfected Wastewater.** Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

(t) **Multiple Units.** Multiple units means two or more units of a treatment process which operate in parallel and serve the same function.

(u) **Standby Unit Process.** A standby unit process is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment for the entire design flow of the unit for which it is a substitute.

(v) **Power Source.** Power source means a source of supplying energy to operate unit processes.

(w) **Standby Power Source.** Standby power source means an automatically actuated self-starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.

(x) **Standby Replacement Equipment.** Standby replacement equipment means reserve parts and equipment to replace broken-down or worn-out units which can be placed in operation within a 24-hour period.

(y) **Standby Chlorinator.** A standby chlorinator means a duplicate chlorinator for reclamation plants having one chlorinator and a duplicate of the largest unit for plants having multiple chlorinator units.

(z) **Multiple Point Chlorination.** Multiple point chlorination means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and/or some intermediate point. It does not include chlorine application for odor control purposes.

(aa) **Alarm.** Alarm means an instrument or device which continuously monitors a specific function of a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.

(bb) **Person.** Person also includes any private entity, city, county, district, the State or any department or agency thereof.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13521, Water Code.

History: 1. New Chapter 4 (§§ 60301–60357, not consecutive) filed 4-2-75; effective thirtieth day thereafter (Register 75, No. 14).

Article 2. Irrigation of Food Crops

60303. Spray Irrigation. Reclaimed water used for the spray irrigation of food crops shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60305. Surface Irrigation. (a) Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

(b) Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground.

60307. Exceptions. Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual case basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.

Article 3. Irrigation of Fodder, Fiber, and Seed Crops

60309. Fodder, Fiber, and Seed Crops. Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.

60311. Pasture for Milking Animals. Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 4. Landscape Irrigation

60313. Landscape Irrigation. Reclaimed water used for the irrigation of golf courses, cemeteries, lawns, parks, playgrounds, freeway landscapes, and landscapes in other areas where the public has access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 5. Recreational Impoundments

60315. Nonrestricted Recreational Impoundment. Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60317. Restricted Recreational Impoundment. Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

60319. Landscape Impoundment. Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 6. Sampling and Analysis

60321. Sampling and Analysis. (a) Samples for settleable solids and coliform bacteria, where required, shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures. Turbidity analysis, where required, shall be performed by a continuous recording turbidimeter.

(b) For uses requiring a level of quality no greater than that of primary effluent, samples shall be analyzed by an approved laboratory method of settleable solids.

(c) For uses requiring an adequately disinfected, oxidized wastewater, samples shall be analyzed by an approved laboratory method for coliform bacteria content.

(d) For uses requiring an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, samples shall be analyzed by approved laboratory methods for turbidity and coliform bacteria content.

Article 7. Engineering Report and Operational Requirements

60323. Engineering Report. (a) No person shall produce or supply reclaimed water for direct reuse from a proposed water reclamation plant unless he files an engineering report.

(b) The report shall be prepared by a properly qualified engineer registered in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the use area.

60325. Personnel. (a) Each reclamation plant shall be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel shall be those meeting requirements established pursuant to Chapter 9 (commencing with Section 13625) of the Water Code.

60327. Maintenance. A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

60329. Operating Records and Reports. (a) Operating records shall be maintained at the reclamation plant or a central depository within the operating agency. These shall include: all analyses specified in the reclamation criteria; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage or disposal; all corrective or preventive action taken.

(b) Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

(c) A monthly summary of operating records as specified under (a) of this section shall be filed monthly with the regulatory agency.

(d) Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the regulatory agency, the State Department of Health, and the local health officer.

60331. Bypass. There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the point of use.

Article 8. General Requirements of Design

60333. Flexibility of Design. The design of process piping, equipment arrangement, and unit structures in the reclamation plant must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the highest possible degree of treatment to be obtained under varying circumstances.

60335. Alarms. (a) Alarm devices required for various unit processes as specified in other sections of these regulations shall be installed to provide warning of:

(1) Loss of power from the normal power supply.
(2) Failure of a biological treatment process.
(3) Failure of a disinfection process.
(4) Failure of a coagulation process.
(5) Failure of a filtration process.
(6) Any other specific process failure for which warning is required by the regulatory agency.

(b) All required alarm devices shall be independent of the normal power supply of the reclamation plant.

(c) The person to be warned shall be the plant operator, superintendent, or any other responsible person designated by the management of the reclamation plant and capable of taking prompt corrective action.

(d) Individual alarm devices may be connected to a master alarm to sound at a location where it can be conveniently observed by the attendant. In case the reclamation plant is not attended full time, the alarm(s) shall be connected to sound at a police station, fire station or other full-time service unit with which arrangements have been made to alert the person in charge at times that the reclamation plant is unattended.

60337. Power Supply. The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source.

(b) Alarm and automatically actuated short-term retention or disposal provisions as specified in Section 60341.

(c) Automatically actuated long-term storage or disposal provisions as specified in Section 60341.

Article 9. Alternative Reliability Requirements for Uses Permitting Primary Effluent

60339. Primary Treatment. Reclamation plants producing reclaimed water exclusively for uses for which primary effluent is permitted shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Long-term storage or disposal provisions as specified in Section 60341.

Article 10. Alternative Reliability Requirements for Uses Requiring Oxidized, Disinfected Wastewater or Oxidized, Coagulated, Clarified, Filtered, Disinfected Wastewater

60341. Emergency Storage or Disposal. (a) Where short-term retention or disposal provisions are used as a reliability feature, these shall consist of facilities reserved for the purpose of storing or disposing of untreated or partially treated wastewater for at least a 24-hour period. The facilities shall include all the necessary diversion devices, provisions for odor control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(b) Where long-term storage or disposal provisions are used as a reliability feature, these shall consist of ponds, reservoirs, percolation areas, downstream sewers leading to other treatment or disposal facilities or any other facilities reserved for the purpose of emergency storage or disposal of untreated or partially treated wastewater. These facilities shall be of sufficient capacity to provide disposal or storage of wastewater for at least 20 days, and shall include all the necessary diversion works, provisions for odor and nuisance control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(c) Diversion to a less demanding reuse is an acceptable alternative to emergency disposal of partially treated wastewater provided that the quality of the partially treated wastewater is suitable for the less demanding reuse.

(d) Subject to prior approval by the regulatory agency, diversion to a discharge point which requires lesser quality of wastewater is an acceptable alternative to emergency disposal of partially treated wastewater.

(e) Automatically actuated short-term retention or disposal provisions and automatically actuated long-term storage or disposal provisions shall include, in addition to provisions of (a), (b), (c), or (d) of this section, all the necessary sensors, instruments, valves and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of failure of a treatment process, and a manual reset to prevent automatic restart until the failure is corrected.

60343. Primary Treatment. All primary treatment unit processes shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

60345. Biological Treatment. All biological treatment unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions, and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

60347. Secondary Sedimentation. All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(a) Multiple sedimentation units capable of treating the entire flow with one unit not in operation.

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

60349. Coagulation.

(a) All coagulation unit processes shall be provided with the following mandatory features for uninterrupted coagulant feed:

(1) Standby feeders,
(2) Adequate chemical storage and conveyance facilities,
(3) Adequate reserve chemical supply, and
(4) Automatic dosage control.

(b) All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;
(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions; or
(5) Alarm and standby coagulation process

60351. Filtration. All filtration unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.
(d) Automatically actuated long-term storage or disposal provisions.
(e) Alarm and standby filtration unit process.

60353. Disinfection.

(a) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorine supply,
(2) Manifold systems to connect chlorine cylinders,
(3) Chlorine scales, and
(4) Automatic devices for switching to full chlorine cylinders.

Automatic residual control of chlorine dosage, automatic measuring and recording of chlorine residual, and hydraulic performance studies may also be required.

(b) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;
(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions; or
(5) Alarm and multiple point chlorination, each with independent power source, separate chlorinator, and separate chlorine supply.

60355. Other Alternatives to Reliability Requirements. Other alternatives to reliability requirements set forth in Articles 8 to 10 may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the proposed alternative will assure an equal degree of reliability.

Article 11. Other Methods of Treatment

60357. Other Methods of Treatment. Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

State of California Department of Health

DRAFT GUIDELINES, Reclamation for Groundwater Recharge

December 1976

L-34

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STATE WATER RESOURCES CONTROL BOARD

WATER CODE

DIVISION 1, CHAPTER 2

Article 3. State Water Resources Control Board

(Article heading added by Stats. 1957, Ch. 1932; amended by Stats. 1967, Ch. 284)

174. The Legislature hereby finds and declares that in order to provide for the orderly and efficient administration of the water resources of the state it is necessary to establish a control board which shall exercise the adjudicatory and regulatory functions of the state in the field of water resources.

It is also the intention of the Legislature to combine the water rights and the water pollution and water quality functions of state government to provide for consideration of water pollution and water quality, and availability of unappropriated water whenever applications for appropriation of water are granted or waste discharge requirements or water quality objectives are established.

(Added by Stats. 1967, Ch. 284.)

175. There is in the Resources Agency the State Water Resources Control Board consisting of five members appointed by the Governor. One of the members appointed shall be an attorney admitted to practice law in this state who is qualified in the fields of water supply and water rights, one shall be a registered civil engineer under the laws of this state who is qualified in the fields of water supply and water rights, one shall be a registered professional engineer under the laws of this state who is experienced in sanitary engineering and who is qualified in the field of water quality, one shall be qualified in the field of water quality, and one member shall not be required to have specialized experience.

Each member shall represent the state at large and not any particular portion thereof and shall serve full time. The appointments so made by the Governor shall be subject to confirmation by the Senate at the next regular or special session of the Legislature, and the refusal or failure of the Senate to confirm an appointment shall create a vacancy in the office to which the appointment was made.

(Formerly 185. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1961, Ch. 2037, Stats. 1967, Ch. 284, by Stats. 1969, Ch. 482, and by Stats. 1972, Ch. 565.)

NOTE: This section modified by Section 13388, added by Stats. 1972, Ch. 1256, which reads:

Notwithstanding any other provision of this division or Section 175, no person shall be a member of the state board or a regional board if he receives or has received during the previous two years a significant portion of his income directly or indirectly from any person subject to waste discharge requirements or applicants for waste discharge requirements pursuant to this chapter. This section shall become operative on March 1, 1973.

175.5. (a) No member of the board shall participate in any board action pursuant to Article 2 (commencing with Section 13320) of Chapter 5 of Division 7 which involves himself or any waste discharger with which he is connected as a director, officer or employee, or in which he has a direct personal financial interest within the meaning of Section 1120 of the Government Code.

(b) No board member shall participate in any proceeding before any regional board as a consultant or in any other capacity on behalf of any waste discharger.

(c) Upon request of any person or on his own initiative the Attorney General may file a complaint in the superior court for the county in which the board has its principal office alleging that a board member has knowingly violated this section and the facts upon which the allegation is based and asking that the member be removed from office. Further proceedings shall be in accordance as near as may be with rules governing civil actions. If after trial the court finds that the board member has knowingly violated this section it shall pronounce judgment that the member be removed from office.

(Amended by Stats. 1971, Ch. 793.)

176. The annual salary of the members of the board is provided for by Chapter 6 (commencing at Section 11550) of Part 1 of Division 3 of Title 2 of the Government Code. Each member of the board shall receive the necessary traveling and other expenses incurred by him in the performance of his official duties out of appropriations made for the support of the board. When necessary the members of the board may travel within or without the State.

(Formerly 186. Added by Stats. 1956 (Ex. Sess.), Ch. 52; amended and renumbered by Stats. 1957, Ch. 1932.)

177. The members of the State Water Rights Board in office on the operative date of the 1967 act amending this section shall continue as members of the State Water Resources Control Board, and their terms shall expire as follows: one member on January 15, 1969, one member on January 15, 1970, and one member on January 15, 1971. The terms of the two additional members of the board provided for by the 1967 act amending Section 175 first appointed by the Governor shall expire as follows: one member on January 15, 1972, and one member on January 15, 1969. Thereafter all members of the board shall be appointed for terms of four years. Vacancies shall be immediately filled by the Governor for the unexpired portion of the terms in which they occur.

(Formerly 187. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1967, Ch. 284.)

178. The members of the board may be removed from office by the Legislature, by concurrent resolution adopted by a majority vote of all members elected to each house, for dereliction of duty or corruption or incompetency.

(Formerly 188. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932.)

179. The board succeeds to and is vested with all of the powers, duties, purposes, responsibilities, and jurisdiction vested in the Department and Director of Public Works, the Division of Water Resources of the Department of Public Works, the State Engineer, the State Water Quality Control Board, or any officer or employee thereof, under Division 2 (commencing with Section 1000), except Part 4 (commencing with Section 4000) and Part 6 (commencing with Section 5900) thereof; and Division 7 (commencing with Section 13000) of this code, or any other law under which permits or licenses to appropriate water are issued, denied, or revoked or under which the functions of water pollution and quality control are exercised.

(Formerly 189. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1967, Ch. 284.)

179.6. The board, or representatives authorized by the board to do so, may call, conduct or attend conferences or hearings, official or unofficial, within or without this state, or otherwise participate in such conferences or hearings with interested persons, agencies or officers, of this or any other state, or with the Congress of the United States, congressional committees, or officers of the federal government, concerning any matter within the scope of the power and duties of the board.

(Added by Stats. 1967, Ch. 284.)

179.7. As to any matter involving the United States, its departments or agencies, which is within the scope of the power and duties of the board, the board may represent the interest of the state or any county, city, state agency or public district upon their request, and to that end may correspond, confer and cooperate with the United States, its departments or agencies, and where necessary the board members, or authorized representatives, may travel either within or without the state.

(Added by Stats. 1967, Ch. 284.)

180. Before entering upon the duties of his office, each member of the board shall execute an official bond to the State in the penal sum of twenty-five thousand dollars ($25,000) conditioned upon the faithful performance of his duties.

(Formerly 190. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932.)

181. The board shall maintain its headquarters at Sacramento and may establish branch offices in such parts of the state as the board deems necessary. The board shall hold meetings at such times and at such places as shall be determined by it. The Governor shall designate the time and place for the first meeting of the board. Three members of the board shall constitute a quorum for the purpose of transacting any business of the board.

(Formerly 191. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1957, Ch. 947. See notes following Section 127. Amended by Stats. 1967, Ch. 284 and Ch. 1656.)

182. The Governor shall designate the chairman of the board from the membership of the board. The person so designated shall hold the office of chairman at the pleasure of the Governor. The board shall elect a vice chairman.

(Formerly 192. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1967, Ch. 284.)

183. The board may hold any hearings and conduct any investigations in any part of the state necessary to carry out the powers vested in it, and for such purposes has the powers conferred upon heads of departments of the state by Article 2 (commencing with Section 11180), Chapter 2, Part 1, Division 3, Title 2 of the Government Code.

Any hearing or investigation by the board may be conducted by any member upon authorization of the board, and he shall have the powers granted to the board by this section, but any final action of the board shall be taken by a majority of all the members of the board, at a meeting duly called and held.

All hearings held by the board or by any member thereof shall be open and public.

(Formerly 193. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1957, Ch. 1824. See second note following Section 127. Amended by Stats. 1967, Ch. 284, Stats. 1969, Chs. 482 and 800, and Stats. 1971, Ch. 1288.)

184. The Department of Water Resources shall have an interest and may appear as a party in any hearing held by the board and may commence or appear in any judicial proceeding brought to inquire into the validity of any action, order, or decision of the board.

(Formerly 194. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932.)

185. The board shall adopt rules for the conduct of its affairs in conformity, as nearly as practicable, with the provisions of Chapter 4.5 (commencing at Section 11371), Part 1, Division 3, Title 2 of the Government Code.

(Former 185 added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered 175 by Stats. 1957, Ch. 1932. Present 185 formerly 195. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932, and amended by Stats. 1969, Chs. 482 and 800.)

186. The board shall have such powers, and may employ such legal counsel and other personnel and assistance, as may be necessary or convenient for the exercise of its duties authorized by law.

For the purpose of administration, the board shall organize itself, with the approval of the Governor, in the manner it deems necessary properly to segregate and conduct the work of the board. The work of the board shall be divided into at least two divisions, known as the Division of Water Rights and the Division of Water Quality. The board shall appoint a chief of each division, who shall supervise the work thereof and act as technical adviser to the board on functions under his jurisdiction.

The Attorney General shall represent the board and the state in litigation concerning affairs of the board unless another state agency, represented by the Attorney General, is a party to the action. In such case the legal counsel of the board shall represent the board. Sections 11041, 11042, and 11043 of the Government Code are not applicable to the State Water Resources Control Board. The legal counsel of the board shall advise and furnish legal services, except representation in litigation, to the regional boards upon their request.

(Former 186 added by Stats. 1956 (Ex. Sess.), Ch. 52; amended and renumbered 176 by Stats. 1957, Ch. 1932. Former 186, as amended by Stats. 1957, Ch. 2424, repealed by Stats. 1959, Ch. 616. Present 186 formerly 196. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats 1967, Ch. 284, and Stats. 1962, Ch. 482, 1962, Ch. 482, Stats. 1971, Ch. 794.)

187. The board, regional water quality control boards, the Department of Water Resources, and other state agencies shall, to the fullest extent possible, exchange records, reports, material, and any other information relating to water, water rights, water pollution or quality, or any areas of mutual concern, to the end that unnecessary duplication of effort may be avoided.

(Former 187 added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered 177 by Stats. 1957, Ch. 1932. Present 187 formerly 197. Added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered by Stats. 1957, Ch. 1932; amended by Stats. 1967, Ch. 284.)

188. The board may expend money appropriated for the administration of the laws the administration of which is committed to the board.

Such expenditures by the board shall be made in accordance with law in carrying on the work for which the appropriations were made.

(Former 188 added by Stats. 1956 (Ex. Sess.), Ch. 52; renumbered 178 by Stats. 1957, Ch. 1932. Present 188 added by Stats. 1957, Ch. 1932.)

188.5. The board shall publish biennial progress reports relating to the activities of the board and California regional water quality control boards.

(Formerly 13020.1; amended and renumbered by Stats. 1967, Ch 284, and Stats. 1969, Ch. 482.)

DIVISION 7.5. TRANSPORTATION AND DISPOSAL OF WASTE

(Added by Stats. 1970, Ch. 902)

CHAPTER 1. LIQUID WASTE HAULERS

Article 1. Declaration of Policy and Definitions

14000. The state board and regional boards in carrying out the provisions of this chapter shall be guided by the policy of Chapter 1 (commencing with Section 13000) of Division 7.

14001. Unless context otherwise requires the definitions set forth in Chapter 2 (commencing with Section 13050) of Division 7 and this article govern the construction of this chapter.

14002. "Liquid waste" includes any solid or gaseous substances contained in such waste from any producing, manufacturing, or processing operation of whatever nature.

"Liquid waste" does not include sewage, fertilizer, or any radioactive material that is subject to the provisions of Chapter 7.3 (commencing with Section 25650) of Division 20 of the Health and Safety Code.

Article 2. Registration

14020. (a) It is unlawful for any person to carry on, or engage in, the business of hauling liquid waste, or the hauling of liquid waste as a part of, or incidental to, any business, unless he holds an unrevoked registration issued by the state board.

The hauling of liquid waste, as used in this chapter, does not include hauling or carriage on water by any watercraft.

(b) The provisions of this chapter may be waived by the state board as to any business, or any type of business, the liquid waste of which the state board finds to be insignificant or unimportant as a contributor to water pollution or contamination or when the state board finds that the business is adequately regulated by another governmental agency. Any waiver under this subdivision shall be conditional and may be terminated at any time.

14021. An application for registration under this chapter shall be filed with the state board. The application shall state the name in full, if a partnership then names of each of the partners, the relation of the applicant to the firm or partnership, the place of business and place of residence of the applicant for registration and of each of the partners in the business, if a partnership, and shall designate, as specifically as practical, the areas and locations where it is proposed to dispose of any liquid waste and the regional water quality control board or boards in whose region or regions such areas are located. The application shall be signed by the authorized officer of a corporation, if a corporation, or by the managing partner, if a partnership.

14022. Registration shall be subject to such terms, conditions, orders, and directions as the state board or its duly authorized representative may at any time deem necessary for the protection of the quality of the waters of the state.

14023. The state board is required to act upon each application within 30 days of the date of filing of such application.

14024. Registration shall be only for the unexpired portion of the calendar year in which registration is issued, and at the end of the calendar year all registrations shall expire, subject to automatic renewal upon payment of the required fees pursuant to Section 14026. The payment of such fees for renewal of registration shall be made between the first day of January and the first day of February of each year.

14025. A change of address of any registrant including a member of a partnership which is registered and of the place of business thereof shall be reported in writing by registered mail by the registrant within 10 days after such change of address.

14026. (a) A registration fee of ten dollars ($10) shall be paid to the state board by each person who carries on, or engages in, the business of hauling liquid waste or who handles liquid waste as a part of, or incidental to, any business, for a calendar year or any portion thereof.

(b) Such person shall also pay to the state board fifteen dollars ($15) for the first vehicle used for the transportation of liquid waste, ten dollars ($10) per vehicle for the second through sixth vehicle, and five dollars ($5) per vehicle for the seventh and any other vehicle, for a calendar year, or a prorated amount thereof for the unexpired portion of a calendar year.

(c) The fees prescribed in subdivisions (a) and (b) shall be payable each year not later than the first day of February or within 30 days after commencing the use of any vehicle to haul liquid waste, whichever occurs later, for administering the provisions of this chapter.

Article 3. Disposing of Liquid Waste

14040. Each regional board shall approve sites suitable for the disposal of different kinds of liquid wastes, consistent with the classifications that shall be adopted by the state board, and may adopt regulations for disposal of liquid waste at such approved sites that it deems are necessary for the protection of the quality of the waters of the state.

14041. The hauler of liquid waste shall dispose of liquid waste in accordance with the regulations adopted by the regional board and on a site approved by the regional board and shall dispose of only such type of liquid waste as was designated for the particular site.

14042. No liquid waste shall be discharged into a community sewer system by a liquid waste hauler without a prior written approval of the operator of such system or his agent. Such approval shall state the authorized hours and place of discharge and type of liquid waste which may be discharged into the community sewer system.

14043. Each person who produces liquid waste which is to be hauled in a vehicle prior to being discharged shall consign or deliver such waste only to a registered liquid waste hauler.

Article 4. Enforcement

14060. The Attorney General, at the request of a regional board or the state board, shall petition the superior court for the issuance of a temporary restraining order, preliminary injunction, or permanent injunction, or combination thereof, as may be appropriate, prohibiting forthwith any person who is violating or threatening to violate any provision of this chapter from continuing such violation or threatened violation, or from in any way hauling or disposing of liquid waste at any location or in any manner which is not in accordance with the provisions of this chapter.

Article 5. Penalties

14080. Any person who violates any provision of Section 14041, 14042, or 14043 is guilty of a misdemeanor.

Article 6. Exemptions

14100. Nothing in this chapter shall be construed to limit the power of any city, county, or city and county to adopt and enforce equal or higher standards in connection with hauling and disposal of liquid waste wholly within the boundaries of any city, county, or city and county.

CHAPTER 9. MUNICIPAL WASTE WATER TREATMENT PLANT CLASSIFICATION AND OPERATOR CERTIFICATION

(Added by Stats. 1972, Ch. 1315.)

13625. As used in this chapter:

(a) "Municipal waste water treatment plant" means the various facilities used in the treatment or reclamation of sewage and industrial wastes.

(b) "Supervisor" means any person who has direct responsibility for the operation of a municipal waste water treatment plant or who supervises any operators of such a plant.

(c) "Operator" means any person who operates a municipal waste water treatment plant.

(d) "Certificate" means a certificate of competency issued by the state board stating that the supervisor or operator has met the requirements for a specific classification in the certification program.

13626. The state board shall classify types of municipal waste water treatment plants for the purpose of determining the levels of competence necessary to operate them. The state board shall adopt and promulgate regulations setting forth the types of plants and the factors on which the state board based its classification.

13627. (a) Supervisors and operators of municipal waste water treatment plants shall possess a certificate of appropriate grade in accordance with, and to the extent recommended by the advisory committee and required by, regulations adopted by the state board. The state board shall develop and specify in its regulations the training necessary to qualify a supervisor or operator for certification for each type and class of plant. The state board may accept experience in lieu of qualification training. In lieu of a properly certified waste water treatment plant operator, the board may approve use of a water treatment plant operator of appropriate grade certified by the State Board of Public Health, where water reclamation is involved.

(b) A person employed as a municipal waste water treatment plant supervisor or operator on the effective date of regulations adopted pursuant to this chapter shall be issued an appropriate certificate provided he meets the training, education, and experience requirements prescribed by regulations.

13628. Certificates issued pursuant to this chapter shall be renewed biennially, subject to compliance by applicants with renewal requirements prescribed by regulations. Fees shall be payable to the state board at the time of issuance of a certificate and at the time of renewal. The state board shall establish a fee schedule to provide revenues to cover the cost of this program.

13629. The state board may approve courses of instruction at higher educational institutions which will qualify operators for each grade of certification. The state board shall also approve courses of instruction given by professional associations, or other nonprofit private or public agencies which shall be deemed equivalent to courses of instruction given by higher educational institutions.

13630. The state board is the state agency which is authorized to represent the state and its local governmental agencies in administering any federal or state funds available for municipal waste water treatment plant operator training. The state board may provide technical and financial assistance to organizations providing operator training programs.

13631. Prior to adopting or revising any regulations or approving any courses for operator training, the state board shall appoint an advisory committee to assist it in carrying out its responsibilities under this chapter.

13632. The advisory committee appointed pursuant to Section 13631 shall consist of the following:

(a) Two persons from a statewide organization representing municipal waste water treatment plant operators and supervisors, who shall be employed in a waste water treatment plant as an operator or supervisor.

(b) Two persons from statewide organizations representing municipalities, including counties.

(c) Two persons from statewide organizations representing local sanitation agencies, other than municipalities.

(d) One person who is a professional engineer specializing in sanitary engineering.

(e) One person from a university or a state college school or division of engineering.

13633. The advisory committee shall review all proposed regulations and make recommendations to the state board prior to adoption of any regulations or changes therein.

13634. This chapter shall not apply to nongovernmentally owned or operated facilities.

Chapter 10. Water Wells and Cathodic Protection Wells

Article 1. Declaration of Policy

13700. The Legislature finds that the greater portion of the water used in this state is obtained from underground sources and that such waters are subject to impairment in quality and purity, causing detriment to the health, safety and welfare of the people of the state. The Legislature therefore declares that the people of the state have a primary interest in the location, construction, maintenance, abandonment and destruction of water wells and cathodic protection wells, which activities directly affect the quality and purity of underground waters.

Article 2. Definitions

13710. "Well" or "water well" as used in this chapter, means any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into, the underground. This definition shall not include: (a) oil and gas wells, or geothermal wells constructed under the jurisdiction of the Department of Conservation, except those wells converted to use as water wells; or (b) wells used for the purpose of (1) dewatering excavation during construction, or (2) stabilizing hillsides or earth embankments.

13711. "Cathodic protection well," as used in this chapter, means any artificial excavation in excess of 50 feet constructed by any method for the purpose of installing equipment or facilities for the protection electrically of metallic equipment in contact with the ground, commonly referred to as cathodic protection.

Article 3. Reports

13750. Every person who hereafter intends to dig, bore, or drill a water well or cathodic protection well, or who intends to deepen or reperforate any such well, or to abandon or destroy any such well, shall file with the department a notice of intent to engage in such construction, alteration, destruction, or abandonment prior to commencing such construction, alteration, destruction, or abandonment; provided, that when such construction, alteration, destruction or abandonment must be accomplished immediately in order to prevent damage to persons or property due to the loss of an existing water supply, such notice shall be filed with the department as soon as possible thereafter, but in any event not more than five days after commencement of such construction, alteration, destruction, or abandonment or repair.

The report shall be made on forms furnished by the department and shall contain such information as the department may require, including, but not limited to: (a) description of the well site sufficiently exact to permit location and identification of the well; (b) proposed date of construction of the well; (c) the use for which the well is intended; (d) the work to be done and a description of type of construction; and (e) in event of late filing, the reasons therefor.

13751. Every person who hereafter digs, bores or drills a water well or cathodic protection well, or abandons or destroys any such well, or who deepens or reperforates any such well, shall file with the department a report of completion of such well within 30 days after its construction or alteration has been completed.

The report shall be made on forms furnished by the department and shall contain such information as the department may require, including, but not limited to: (a) description of the well site sufficiently exact to permit location and identification of the well; (b) detailed log of the well; (c) description of type of construction; (d) details of perforation; and (e) methods used for sealing off surface or contaminated waters.

13752. Reports made pursuant to Section 13751 shall not be made available for inspection by the public but shall be made available to governmental agencies for use in making studies; provided, that any report shall be made available to any person who obtains a written authorization from the owner of the well.

13753. Every person who hereafter converts, for use as a water well or cathodic protection well, any oil or gas well originally constructed under the jurisdiction of the Department of Conservation pursuant to the provisions of Article 4 (commencing with Section 3200), Chapter 1, Division 3 of the Public Resources Code, shall comply with all provisions of this chapter.

13754. Failure to comply with any provision of this article, or willful and deliberate falsification of any report required by this article, is a misdemeanor.

Before commencing prosecution against any person, other than for willful and deliberate falsification of any report required by this article, the person shall be given reasonable opportunity to comply with the provisions of this article.

13755. Nothing in this chapter shall affect the powers and duties of the State Department of Health with respect to water and water systems pursuant to Chapter 7 (commencing with Section 4010) of Division 5 of the Health and Safety Code. Every person shall comply with this chapter and any regulation adopted pursuant thereto, in addition to standards adopted by any city or county.

Article 4. Quality Control

13800. **The department, after such studies and investigation pursuant to Section 231 as it finds necessary, on determining that water well and cathodic protection well construction, maintenance, abandonment, and destruction standards are needed in an area to protect the quality of water used or which may be used for any beneficial use, shall so report to the appropriate regional water quality control board** and to the State Department of Health. The report shall contain such recommended standards for water well and cathodic protection well construction, maintenance, abandonment, and destruction as, in the department's opinion, are necessary to protect the quality of any affected water.

13801. **The regional board upon receipt of a report from the department shall hold a public hearing on the need to establish such well standards for the area involved. The regional board may hold such a public hearing with respect to any area regardless of whether a report has been received from the department if it has information that such standards may be needed.**

13802. If the regional board finds that standards of water well and cathodic protection well construction, maintenance, abandonment, and destruction are needed in any area to protect the quality of water used, or which may be used, for any beneficial use, it shall determine the area to be involved and so report to each affected county and city in the area. The report shall also contain any well standards which have been recommended by the department.

13803. Each such affected county and city shall, within 120 days of receipt of the report, adopt an ordinance establishing standards of water well and cathodic protection well construction, maintenance, abandonment, and destruction for the area designated by the regional board. Prior to adoption of such ordinance each affected county and city shall consult with all interested parties, including licensed well drillers. A copy of such ordinance shall be sent to the regional board on its adoption and the regional board shall transmit such ordinance to the department for its review and comments.

13804. Such county and city well standards shall take effect 60 days from the date of their adoption by the county or city unless the regional board, on its own motion, or on the request of any affected person, holds a public hearing on the matter and determines that the county or city well standards are not sufficiently restrictive to protect the quality of the affected waters. If the board makes such a determination it shall so report to the affected county or city and also recommend the well standards, or the modification of the county or city well standards, which it determines are necessary.

13805. If a county or city fails to adopt an ordinance establishing water well and cathodic protection well construction, maintenance, abandonment, and destruction standards within 120 days of receipt of the regional board's report of its determination that such standards are necessary pursuant to Section 13802, or fails to adopt or modify such well standards in the manner determined as necessary by the regional board pursuant to Section 13804 within 90 days of receipt of the regional board's report, the regional board may adopt standards for water well and cathodic protection well construction, maintenance, abandonment, and destruction for the area. Such regional board well standards shall take effect 30 days from the date of their adoption by the regional board and shall be enforced by the city or county and have the same force and effect as if adopted as a county or city ordinance.

(Amended by Stats. 1970, Ch. 918.)

13806. **Any action, report, or determination taken or adopted by a regional board or any failure of a regional board to act pursuant to** this article, or any county or city ordinance in the event of the failure of a regional board to review such ordinance pursuant to Section 13804, may be reviewed by the state board on its own motion, and shall be reviewed by the state board on the request of any affected county or city, in the same manner as other action or inaction of the regional board is reviewed pursuant to Section 13320. The state board has the same powers as to the review of action or inaction of a regional board or of a county or city ordinance under this article as it has as to other action or inaction of a regional board under Section 13320, including being vested with all the powers granted a regional board under this article, with like force and effect if it finds that appropriate action has not been taken by a regional board. Any action of a regional board under this article or any county or city ordinance affected by the review of the state board shall have no force or effect during the period of the review by the state board.

(Amended Stats. 1969, Ch. 800.)

CHAPTER 11. DISCHARGES FROM HOUSEBOATS ON OR IN THE WATERS OF THE STATE

13900. The Legislature finds and hereby declares that discharges from houseboats in or on the waters of the state constitute a significant source of waste as defined in Section 13050; that discharges of waste from houseboats in or on the waters of the state may impair the beneficial uses of the waters of the state to the detriment of the health, safety, and welfare of the people of the state; and that the discharges of waste from houseboats are not adequately regulated. The Legislature therefore declares that the people of the state have a primary interest in the coordination and implementation of the regulation of discharges of waste from houseboats on or in the waters of the state.

13901. **As used in this article, "houseboat" means a watercraft or industrial or commercial structure on or in the waters of the state,** floating or nonfloating, which is designed or fitted out as a place of habitation and is not principally used for transportation. "Houseboat" includes platforms, and waterborne hotels and restaurants. "City or county" means any city, county, city and county, or port authority.

13902. Each regional board shall investigate its region to determine areas in which discharges of waste from houseboats are inadequately regulated by local ordinance.

13903. Each regional board shall notify each affected city or county, the State Department of Health and the Department of Navigation and Ocean Development * of areas of inadequate regulation by ordinance of discharges of waste from houseboats and shall recommend provisions necessary to control the discharges of waste from houseboats into the waters.

13904. Each such affected city or county shall within 120 days of receipt of the notice from the regional board, adopt an ordinance for control of discharges of waste from houseboats within the area for which notice was given by the board. A copy of such ordinance shall be sent to the regional board on its adoption and the regional board shall transmit such ordinance to the state board, the State Department of Health and the Department of Navigation and Ocean Development.

13905. Such city or county ordinance shall take effect 60 days from the date of adoption by the city or county, unless the regional board holds a public hearing on the matter and determines that the city or county ordinance is not sufficiently restrictive to protect the quality of the waters affected. If the board makes such a determination, it shall so report to the affected city or county and also recommend the ordinance, or modification of the city or county ordinance, which it determines is necessary.

13906. If a city or county fails to adopt an ordinance controlling discharges of waste from houseboats within 120 days of receipt of the regional board's notice pursuant to Section 13903, or fails to adopt or modify such ordinance in the manner determined as necessary by the regional board pursuant to Section 13905, within 90 days of receipt of the regional board's notice, the regional board may adopt regulations necessary for the control of discharges of waste from houseboats for the area designated. Such regional board regulations shall take effect 30 days from the date of their adoption and shall be enforced by the city or county and have the same force and effect as if adopted as a city or county ordinance.

13907. Any action, report, determination, or regulation taken or adopted by a regional board, or any failure of a regional board to act may be reviewed by the state board, and shall be reviewed by the state board on the request of any affected city or county. The state board has all powers as to the review of action or inaction of a regional board under this article as it has to other action or inaction of a regional board, including all powers granted to a regional board to initially determine areas in which discharges of waste from houseboats are inadequately regulated by local ordinance and to adopt regulations when a city or county fails to do so, if the state board finds that appropriate action has not been taken by a regional board. Any action of a regional board under this chapter or any city or county ordinance affected by the review of the state board shall have no force or effect during the period of the review by the state board.

(Amended by Stats. 1969, Ch. 800.)

13908. No provision in this chapter and no action thereunder by a regional board or the state board is a limitation on the power of a city or county to adopt and enforce additional ordinances or regulations not in conflict therewith imposing further conditions, restrictions, or limitations with respect to the discharges of waste from houseboats.

Chapter 12. Special Water Quality Provisions

13950. Notwithstanding any other provision of law, upon any district in the Lake Tahoe Basin providing in any area of the district a sewer system and treatment facilities sufficient to handle and treat any resultant waste and transportation facilities sufficient to transport any resultant effluent outside the Lake Tahoe Basin, the further maintenance or use of cesspools or other means of waste disposal in such area is a public nuisance and the district shall require all buildings from which waste is discharged to be connected with the sewer system within a period of not less than 90 days from the completion of such system and facilities.

(Added by Stats. 1969 Ch. 800.)

13951. Notwithstanding any other provision of law, on or after January 1, 1972, waste from within the Lake Tahoe watershed shall be placed only into a sewer system and treatment facilities sufficient to handle and treat any such waste and transportation facilities sufficient to transport any resultant effluent outside the Lake Tahoe watershed, except that such waste may be placed in a holding tank which is pumped and transported to such treatment and transportation facilities.

As used in this section "waste" shall not include solid waste refuse.

The further maintenance or use of cesspools, septic tanks, or other means of waste disposal in the Lake Tahoe watershed on or after January 1, 1972, by any person, except as permitted pursuant to this section, is a public nuisance. The occupancy of any building from which waste is discharged in violation of this section is a public nuisance, and an action may be brought to enjoin any person from occupying any such building.

This section shall not be applicable to a particular area of the Lake Tahoe watershed whenever the regional board for the Lahontan region finds that the continued operation of septic tanks, cesspools, or other means of waste disposal in such area will not, individually or collectively, directly or indirectly, affect the quality of the waters of Lake Tahoe and that the sewering of such area would have a damaging effect upon the environment.

This section shall not affect the applicability of Section 13950.

(Added by Stats. 1969, Ch. 1356.)

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This act [the Porter-Cologne Water Quality Control Act] is intended to implement the legislative recommendations of the final report of the

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* Note: Formerly called State Department of Harbors and Watercraft.

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR IRRIGATION AND IMPOUNDMENTS

A. General

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the requirements specified in the Wastewater Reclamation Criteria, established by the State of California Department of Health for health protection.

2. The discharge should be confined to the area designated and approved for disposal and reuse.

3. Maximum attainable separation of reclaimed water lines and domestic water lines should be practiced. Domestic and reclaimed water transmission and distribution mains should conform to the "Separation and Construction Criteria" (see attached).

    a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

    b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves and outlets should be appropriately tagged to warn the public and employees that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

6. All reclaimed water valves, outlets, and sprinkler heads should be of a type that can only be operated by authorized personnel.

    a. Where hose bibbs are present on domestic and reclaimed water lines, differential sizes should be established to preclude the interchange of hoses.

7. Adequate means of notification should be provided to inform the public that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

8. Adequate measures should be taken to prevent the breeding of flies, mosquitoes and other vectors of public health significance during the process of reuse.

9. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin.

B. Spray Irrigation of Crops

1. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

2. Irrigation should be done so as to prevent contact by the public with the sprayed material and precautions should be taken to insure that reclaimed water will not be sprayed on walkways, passing vehicles, buildings, domestic water facilities, or areas not under control of the user.

    a. The irrigated areas should be fenced where primary effluent is used.

    b. Windblown spray from the irrigation area should not reach areas accessible to the public.

3. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

4. Adequate time should be provided between the last irrigation and harvesting to allow the crops and soil to dry.

    a. Animals, especially milking animals, should not be allowed to graze on land irrigated with reclaimed water until it is thoroughly dry.

5. There should be no subsequent planting of produce on lands irrigated with primary effluent.

C. Surface Irrigation of Crops

1. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

2. The public should be effectively excluded from contact with the reclaimed water used for irrigation.

    a. The irrigated areas should be fenced where primary effluent is used.

3. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

4. Adequate time should be provided between the last irrigation and harvesting to allow the crops and soil to dry.

    a. Animals, especially milking animals, should not be allowed to graze on land irrigated with reclaimed water until it is thoroughly dry.

5. There should be no subsequent planting of produce on lands irrigated with primary effluent.

6. Adequate measures must be taken to prevent any direct contact between the edible portion of the crops and the reclaimed water.

D. Landscape Irrigation

1. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

2. At golf courses, notices should be printed on score cards stating that reclaimed water is used, and all water hazards containing reclaimed water should be posted with warning signs.

3. Tank trucks used for carrying or spraying reclaimed water should be appropriately identified to indicate such.

4. Irrigation should be done so as to prevent or minimize contact by the public with the sprayed material and precautions should be taken to insure that reclaimed water will not be sprayed on walkways, passing vehicles, buildings, picnic tables, domestic water facilities, or areas not under control of the user.

   a. Irrigation should be practiced during periods when the grounds will have maximum opportunity to dry before use by the public unless provisions are made to exclude the public from areas during and after spraying with reclaimed water.

   b. Windblown spray from the irrigation area should not reach areas accessible to the public.

   c. Drinking water fountains should be protected from direct or windblown reclaimed water spray.

5. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

E. Impoundments

1. Runoff should be contained and properly disposed.

2. At restricted recreational impoundments and landscape impoundments all valves and outlets should be appropriately tagged to warn the public that the water is not safe for drinking or bathing.

3. At nonrestricted recreational impoundments all valves and outlets should be appropriately tagged to warn the public that the water is reclaimed from sewage and is not safe for drinking.

4. Adequate measures should be taken to prevent body contact activities, such as wading or swimming, at restricted recreational impoundments containing reclaimed water.

5. Adequate measures should be taken to prevent direct public contact with reclaimed water at landscape impoundments.

6. Restricted and nonrestricted recreational impoundments should be maintained under the continuous supervision of qualified personnel during periods of use.

7. Impoundments containing reclaimed water must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

JC:gm
10/20/76

SEPARATION AND CONSTRUCTION CRITERIA
DOMESTIC AND RECLAIMED WASTEWATER TRANSMISSION AND DISTRIBUTION MAINS

BASIC SEPARATION		WATER MAIN INVOLVED		RECLAIMED WASTEWATER MAIN CONSTRUCTION MINIMUM SEPARATION IF BASIC SEPARATION IS NOT FEASIBLE		
Parallel Construction	Perpendicular Construction	Reclaimed Wastewater	Domestic Water	Parallel Construction	Perpendicular Construction Reclaimed wastewater main above domestic water main	Perpendicular Construction Reclaimed wastewater main below domestic water main Clearance less than three (3) feet
(a) 25'	(b) 3'	Pressure	(c) Gravity	No Exception	Minimum pipe class 2 x wwp; Steel casing 25' both sides of crossing	Minimum pipe class 2 x wwp; Steel casing 25' both sides of crossing
25'	3'	Gravity	Gravity	VCP, AC, CIP, or equal, class 150; 15' minimum separation; Mechanical compression joints	Steel casing 25' both sides of crossing	VCP, AC, CIP, or equal, class 150; Mechanical compression joints 25' both sides of crossing
10'	3'	Pressure	Pressure	Minimum pipe class 2 x wwp; 4' minimum separation; no common trench	Minimum pipe class 2 x wwp; Mechanical compression joints 4' both sides of crossing	Minimum pipe class 2 x wwp; Mechanical compression joints 4' both sides of crossing
10'	3'	Gravity	Pressure	VCP; Mechanical compression joints 4' minimum separation	Concrete encasement or steel casing 4' both sides of crossing	VCP, AC, CIP; Mechanical compression joints 4' both sides of crossing

(a) All distances measured from pipeline O.D.
(b) Domestic water main 3' above reclaimed wastewater main.
(c) Less than 5 psi.

DRAFT

INTENT OF REGULATION

These regulations prescribe criteria for reclaimed water intended for recharge by surface spreading to a subterranean water bearing stratum that is used or intended to be used as, or is suitable for, a source of water supply for domestic purposes. Such recharge projects constitute a controlled use of reclaimed water which require reclamation criteria.

The regulations are particularly directed at the control of stable organic substances because of the possible health effects which may be associated with long-term ingestion. A national effort is underway to determine the presence, concentration, and health significance of organic chemicals in water. Limits cannot be specified at present because of the lack of knowledge of health effects and the large number of compounds which may be present.

The regulations provide for control of organic chemicals and other contaminants through process and quality requirements, and requirements directed at the recharge operation. These elements of control may be modified as more information becomes available.

The combination of controls called for in the regulations are the minimum requirements which the Department of Health considers to be necessary for groundwater recharge by surface spreading based on present information. The treatment required in the regulations is conventional secondary treatment followed by carbon adsorption and percolation through the soil. The latter two processes have been demonstrated to be effective and reliable for the reduction of organic compounds in treated wastewater. Further advanced wastewater treatment directed at organic chemical removal could be provided; however, there is no information on the health protection benefits which would be obtained by this additional treatment. Moreover, it has been pointed out by wastewater management authorities that further advanced treatment would preclude groundwater recharge with reclaimed water because of the high cost and energy requirements. Consequently, the regulations require this minimum treatment chain supplemented by operational controls.

The basic intent of the regulations is to assure that the groundwaters which are augmented with recharged reclaimed waters are suitable for domestic water supply. An elemental condition to achieve this intent is that the quality of the reclaimed water after treatment and soil percolation meet the mandatory chemical and physical standards for drinking water in California. These standards address a limited number of contaminants and are by no means considered to be "all inclusive." They do not contain maximum acceptable limits for the numerous organic chemical compounds which may be present in wastewater because, in most cases, the limits are not known. Dependence is placed on the effective performance of the wastewater treatment and soil percolation processes to assure adequate removal of organic compounds. In order to demonstrate effective performance as well as to substantiate that only low concentrations of total organic material remain in the reclaimed water, limits are specified for chemical oxygen demand and total organic carbon. These organic analyses are to be performed at least daily in order to serve effectively as indicators of treatment effectiveness.

The monitoring of the reclaimed water for the chemical and physical standards for drinking water is required at quarterly intervals. Within the limits of reasonable monitoring frequency, significant amounts of reclaimed water of unacceptable quality could be recharged in the intervals between sampling. The presence of unacceptable quality conditions can be detected much more readily in the groundwater than in the reclaimed water because of the slower movement and quality changes of groundwater. Consequently, a groundwater monitoring program is required which will determine water quality prior to extraction at domestic water supply wells.

A time requirement of one year retention underground has been specified for several reasons. The time period would allow an adequate interval for detection and correction of any adverse groundwater quality conditions resulting from the recharge before the groundwater reaches domestic water supply wells. The time requirement would also assure the absence of biological pathogens. No disinfection requirement has been applied to the reclaimed water and, although soil percolation has been demonstrated to be reasonably effective in the removal of bacteria and virus, the time requirement would provide assurance of pathogen elimination.

The intent of the quantity requirement is to assure that not more than 50% of the water extracted from any point in a groundwater basin is of reclaimed water origin. The long term domestic use of reclaimed water without this minimum amount of dilution is not acceptable to the Department of Health. Direct evidence of meeting the dilution requirement would be provided by spreading equal amounts of natural waters with the reclaimed water during the year. In the absence of this, strong evidence would be required that dilution with natural groundwaters would at all times occur.

The regulations are intended to apply to wastewaters from residential communities and not highly industralized areas where concern with toxic substances would be much greater. In order to identify the types of wastewater which contribute to the wastewater reclamation operation and to minimize adverse effects which may be associated with wastewaters of other than domestic origin, a source control program is required. This program should follow the program described in the California State Water Resources Control Board document, "Guidelines for Determining Effectiveness of Local Source Control Program."

In order to provide opportunity for the development of information on groundwater recharge under selected and controlled conditions, groundwater recharge demonstration projects which do not provide the prescribed treatment may be approved by the Department of Health on a case-by-case basis. Such demonstration projects must be preceded by adequate pilot studies and shall be installed only where there is minimum human exposure.

GROUNDWATER RECHARGE REGULATIONS

A. DEFINITIONS

Carbon Adsorption Unit Process. A carbon adsorption unit process is a process in which wastewater is passed through a bed of activated carbon and which provides a minimum empty bed contact time of 30 minutes.

Groundwater Recharge. Groundwater recharge is the augmentation of underground waters by surface spreading of reclaimed water.

B. QUALITY REQUIREMENTS

1. Reclaimed Water Quality Requirements

Reclaimed water used for groundwater recharge of domestic water supply aquifers shall be at all times an adequately oxidized wastewater which has received treatment by the unit process of carbon adsorption and which has percolated through an unsaturated zone of undisturbed soil for a minimum vertical distance of 10 feet.

Reclaimed water used for groundwater recharge shall not exceed the limiting concentrations specified in Tables 1-4.

Table 1

LIMITING CONCENTRATIONS

Inorganic Chemicals

Constituent	Limiting Concentration, mg/1
Arsenic	0.10
Barium	1.0
Cadmium	0.01
Chromium	0.05
Cyanide	0.2
Lead	0.05
Mercury	0.005
Nitrate-N + Nitrite-N	10
Selenium	0.01

Table 2

LIMITING CONCENTRATIONS

Fluoride Concentration

Annual Average of Maximum Daily Air Temperature	Fluoride Concentration, mg/1		
	Lower	Optimum	Upper
50-54	0.9	1.2	1.7
55-58	0.8	1.1	1.5
59-64	0.8	1.0	1.3
65-71	0.7	0.9	1.2
72-79	0.7	0.8	1.0
80-81	0.6	0.7	0.8

Table 3

LIMITING CONCENTRATIONS

Organic Chemicals

Constituent	Limiting Concentration, mg/1	
Carbon-alcohol extract (CAE-m)	3.0	
Carbon-chloroform extract (CCE-m)	0.7	
Foaming agent (MBAS)	0.5	
Pesticides:		
Aldrin	0.017	
Chlordane	0.003	
DDT	0.042	
Dieldrin	0.017	
Endrin	0.001	
Heptachlor	0.018	
Heptachlor epoxide	0.018	
Lindane	0.056	
Methoxychlor	1.0	
Organophosphorous and Carbamate compounds	0.1	As parathion in cholinesterase inhibition
Toxaphene	0.005	
Herbicides:		
2,4-D plus 2, 4, 5-T plus 2, 4, 5-TP	0.1	

Table 4

LIMITING CONCENTRATIONS

Radioactivity

Gross Beta	1,000 pc/l
Radium-226	3 pc/l
Strontium-90	10 pc/l

Samples for constituents specified in Tables 1-4 shall be collected and analyzed at least quarterly.

The chemical oxygen demand (COD) of the reclaimed water shall not exceed 5.0 mg/l in any sample.

The total organic carbon (TOC) concentration in the reclaimed water shall not exceed 3.0 mg/l in any sample.

Samples for COD and TOC shall be collected and analyzed at least daily.

2. Groundwater Quality Requirements

Groundwater influenced by the recharge operation shall be sampled and analyzed for the constituents specified in Tables 1-4 and Tables 5 and 6.

Table 5

Constituents	mg/l
Color--Units	15
Copper	1.0
Iron	0.3
Manganese	0.05
Odor--Threshold	3
Zinc	5.0

Table 6

Constituents	mg/l
Total Dissolved Solids	1,000
or	
Specific Conductance	1,600 micromhos
Chloride	500
Sulfate	500

Samples for constituents specified in Tables 1-4 and Tables 5 and 6 shall be collected and analyzed at least quarterly.

C. QUANTITY REQUIREMENT

Not more than 50 percent of the water entering a groundwater basin at a spreading area during any 12-month period shall be reclaimed water.

D. TIME REQUIREMENT

Reclaimed water shall remain in the underground basin for a minimum of one year prior to withdrawal from a community domestic water supply well.

E. REQUIRED STUDIES AND REPORTS

1. Hydrogeologic Study

Prior to any planned groundwater recharge with reclaimed water, a hydrogeologic study shall be conducted which will determine the movement of recharged reclaimed water and which will demonstrate compliance with the minimum time and vertical distance requirements.

2. Spreading Area Practices

A report specifying the operating practices and procedures that will be carried out at the reclaimed water spreading area shall be submitted to the regulatory agency and the State Department of Health for review and approval. The report shall include: means for compliance with the requirement of a 10-foot separation between the ground surface and the groundwater table; operation procedures to assure maintenance of an aerobic zone between the ground surface and the groundwater table; and other measures to optimize treatment by the soil system.

3. Source Control

A source control program shall be established to control the discharge of toxic industrial chemical compounds into the sewer collection system served by the reclaimed wastewater treatment.

4. Contingency Plan

A contingency plan shall be established which will specify corrective measures to be taken in the event that groundwaters are determined not to be safe for human consumption as a result of the recharge operation.

F. MONITORING REQUIREMENTS

1. Organic Chemical Monitoring

The reclaimed water shall be sampled and analyzed for the following constituents:

benzene
carbon tetrachloride
p-dichlorobenzene
vinyl chloride
1,2,4-trichlorobenzene
bis-(2-chloroethyl) ether
11,12-benzofluoranthene
1,1,2-trichloroethylene
2,4-dichlorophenol
fluoranthene
3,4-benzophyrene
indeno (1,2,3-cd) pyrene
chloroform
bromodichloromethane
bromoform
1,2-dichloroethane
polychlorinated byphenyls
pentachlorophenol
3,4-benzofluoranthene
1,12-benzoperylene

Samples for specific organic constituents shall be collected and analyzed at least quarterly.

2. Health Monitoring

A health monitoring program of the population receiving water from the recharged basin may be required. The local Health Officer and the State Department of Health shall determine the need for health monitoring and shall specify the elements of the program to be carried out by those responsible for the recharge operation.

G. EXCEPTIONS

The regulations do not apply to any discrete groundwater basin or subbasin which is dedicated to a use other than domestic drinking water supply, or to a spreading operation which is part of a groundwater management program that effectively prevents movement of the reclaimed water to portions of the basin used for domestic water supply.

Groundwater recharge demonstration projects which do not provide the treatment specified in Section B may be approved by the Department of Health on a case-by-case basis. Such demonstration projects must be preceded by adequate pilot studies and installed where there is minimum human exposure.

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federal register

WEDNESDAY, FEBRUARY 11, 1976

PART IV:

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATIVE WASTE MANAGEMENT TECHNIQUES FOR BEST PRACTICABLE WASTE TREATMENT

Supplement

ENVIRONMENTAL PROTECTION AGENCY

[FRL 480-6]

ALTERNATIVE WASTE MANAGEMENT TECHNIQUES FOR BEST PRACTICABLE WASTE TREATMENT

Supplement

Pursuant to Section 304(d)(2) of the Federal Water Pollution Control Act Amendments of 1972 (Pub. L. 92-500), the Environmental Protection Agency (EPA), gave notice on October 23, 1975 (40 FR 49868) that Alternative Waste Management Techniques for Best Practicable Waste Treatment has been published in final form. The final report contains the criteria for best practicable waste treatment technology and information on alternative waste management techniques.

The criteria for Best Practicable Waste Treatment for Alternatives employing land application techniques and land utilization practices required that the ground water resulting from land application of wastewater meet the standards for chemical quality [inorganic chemicals] and pesticides [organic chemicals] specified in the EPA Manual for Evaluating Public Drinking Water Supplies in the case of groundwater which potentially can be used for drinking water supply. In addition to the standards for chemical quality and pesticides, the bacteriological standards [microbiological contaminants] specified in the EPA Manual for Evaluating Drinking Water Supplies were required in the case of groundwater which is presently being used as a drinking water supply. The pertinent section of the EPA Manual for Evaluating Public Drinking Water Supplies was included as Appendix D of the Alternative Waste Management Techniques for Best Practicable Waste Treatment report.

Also specified in the Criteria for Best Practicable Waste Treatment is that "any chemical, pesticides, or bacteriological standards for drinking water supply sources hereafter issued by EPA shall automatically apply in lieu of the standards in the EPA Manual for Evaluating Public Drinking Water Supplies. The National Interim Primary Drinking Water Regulations were published in final form on December 24, 1975.

In consideration of the foregoing, Chapter II and Appendix D of Alternative Waste Management Techniques for Best Practicable Waste Treatment shall read as follows.

Dated: February 4, 1976.

RUSSELL E. TRAIN,
Administrator.

CHAPTER II

CRITERIA FOR BEST PRACTICABLE WASTE TREATMENT

Applicants for construction grant funds authorized by Section 201 of the Act must have evaluated alternative waste treatment management techniques and selected the technique which will provide for the application of best practicable waste treatment technology. Alternatives must be considered in three broad broad categories: treatment and discharge into navigable waters, land application and utilization practices, and reuse of treated wastewater. An alternative is "best practicable" if it is determined to be cost-effective in accordance with the procedures set forth in 40 CFR Part 35 (Appendix B to this document) and if it will meet the criteria set forth below.

(A) Alternatives Employing Treatment and Discharge into Navigable Waters. Publicly-owned treatment works employing treatment and discharge into navigable waters shall, as a minimum, achieve the degree of treatment attainable by the application of secondary treatment as defined in 40 CFR 133 (Appendix C). Requirements for additional treatment, or alternate management techniques, will depend on several factors, including availability of cost-effective technology, cost and the specific characteristics of the affected receiving water body.

(B) Alternatives Employing Land Application Techniques and Land Utilization Practices. Publicly-owned treatment works employing land application techniques and land utilization practices which result in a discharge to navigable waters shall meet the criteria for treatment and discharge under Paragraph (A) above.

The ground water resulting from the land application of wastewater, including the affected native ground water, shall meet the following criteria:

Case I. The ground water can potentially be used for drinking water supply.

(1) The maximum contaminant levels for inorganic chemicals and organic chemicals specified in the National Interim Primary Drinking Water Regulations (40 CFR 141) (Appendix D) for drinking water supply systems should not be exceeded except as indicated below (see Note 1).

(2) If the existing concentration of a parameter exceeds the maximum contaminant levels for inorganic chemicals or organic chemicals, there should not be an increase in the concentration of that parameter due to land application of wastewater.

Case II. The ground water is used for drinking water supply.

(1) The criteria for Case I should be met.

(2) The maximum microbiological contaminant levels for drinking water supply systems specified in the National Interim Primary Drinking Water Regulations (40 CFR 141) (Appendix D) should not be exceeded in cases where the ground water is used without disinfection (see Note 1).

Case III. Uses other than drinking water supply.

(1) Ground water criteria should be established by the Regional Administrator based on the present or potential use of the ground water.

The Regional Administrator in conjunction with the appropriate State officials and the grantee shall determine on a site-by-site basis the areas in the vicinity of a specific land application site where the criteria in Case I, II, and III shall apply. Specifically determined shall be the monitoring requirements appropriate for the project site. This determination shall be made with the objective of protecting the ground water for use as a drinking water supply and/or other designated uses as appropriate and preventing irrevocable damage to ground water. Requirements shall include provisions for monitoring the effect on the native ground water.

(C) Alternatives Employing Reuse. The total quantity of any pollutant in the effluent from a reuse project which is directly attributable to the effluent from a publicly-owned treatment works shall not exceed that which would have been allowed under Paragraphs (A) and (B) above.

NOTE 1.—Any amendments of the National Interim Primary Drinking Water Regulations and any National Revised Primary Drinking Water Regulations hereafter issued by EPA prescribing standards for public water systems relating to inorganic chemicals, organic chemicals or microbiological contamination shall automatically apply in the same manner as the National Interim Primary Drinking Water Regulations.

APPENDIX D

GROUND WATER REQUIREMENTS

The following maximum contaminant levels contained in the National Interim Primary Drinking Water Regulations (40 CFR 141) are reprinted for convenience and clarity. The National Interim Primary Drinking Water Regulations were published in final form in the FEDERAL REGISTER on December 24, 1975. In accordance with the criteria for best practicable waste treatment, 40 CFR 141 should be consulted in its entirety when applying the standards contained therein to wastewater treatment systems employing land application techniques and land utilization practices.

Maximum contaminant levels for inorganic chemicals. The following are the maximum levels of inorganic chemicals other than fluoride:

Contaminant	*Level (milligrams per liter)*
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05

The maximum contaminant levels for fluoride are:

Temperature degrees Fahrenheit[1]	Degrees Celsius	Level (milligrams per liter)
53.7 and below	12 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

[1] Annual average of the maximum daily air temperature.

Maximum contaminant levels for organic chemicals. The following are the maximum contaminant levels for organic chemicals:

	Level (milligram per liter)
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-Hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis [p-methoxyphenyl] ethane)	0.1
Toxaphene ($C_{10}H_{10}Cl_8$ - Technical chlorinated camphene, 67 to 69 percent chlorine)	0.005
(b) Chlorophenoxys:	
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01

Maximum microbiological contaminant levels. The maximum contaminant levels for coliform bacteria, applicable to community water systems and non-community water systems, are as follows:

(a) When the membrane filter technique pursuant to § 141.21(a) is used, the number of coliform bacteria shall not exceed any of the following:

(1) One per 100 milliliters as the arithmetic mean of all samples examined per month pursuant to § 141.21 (b) or (c);

(2) Four per 100 milliliters in more than one sample when less than 20 are examined per month; or

(3) Four per 100 milliliters in more than five percent of the samples when 20 or more are examined per month.

(b) (1) When the fermentation tube method and 10 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

(i) More than 10 percent of the portions in any month pursuant to § 141.21 (b) or (c);

(ii) Three or more portions in more than one sample when less than 20 samples are examined per month; or

(iii) Three or more portions in more than five percent of the samples when 20 or more samples are examined per month.

(2) When the fermentation tube method and 100 milliliter standard portions pursuant to § 141.21(a) are used, coliform bacteria shall not be present in any of the following:

(i) More than 60 percent of the portions in any month pursuant to § 141.21 (b) or (c);

(ii) Five portions in more than one sample when less than five samples are examined per month; or

(iii) Five portions in more than 20 percent of the samples when five or more samples are examined per month.

(c) For community or non-community systems that are required to sample at a rate of less than 4 per month, compliance with Paragraphs (a), (b) (1), or (2) shall be based upon sampling during a 3 month period, except that, at the discretion of the State, compliance may be based upon sampling during a one-month period.

[FR Doc.76-3973 Filed 2-10-76;8:45 am]

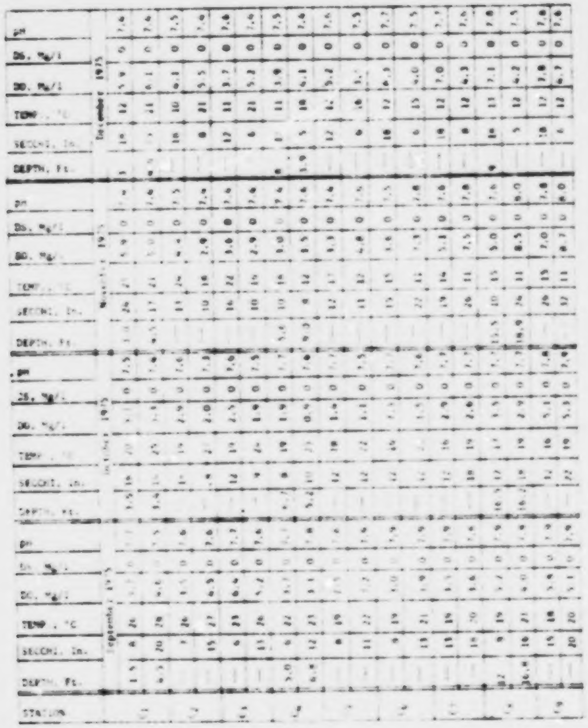
[illegible]
[illegible]
AND [illegible] SAN [illegible] BAY - [illegible]

pH	[illegible]	[illegible]
DO Mg/l	[illegible]	[illegible]
DO Mg/l	[illegible]	[illegible]
Temp.	[illegible]	[illegible]
Secchi, In.	[illegible]	[illegible]
Depth, F.		[illegible]
pH		[illegible]
DO Mg/l		[illegible]
DO Mg/l	[illegible] 1975	[illegible]
Temp.		[illegible]
Secchi, In.		[illegible]
Depth, F.		[illegible]
pH		[illegible]
DO Mg/l		[illegible]
DO Mg/l	[illegible]	[illegible]
Temp.		[illegible]
Secchi, In.		[illegible]
Depth, F.		[illegible]
pH		[illegible]
DO Mg/l		[illegible]
DO Mg/l	[illegible]	[illegible]
Temp.		[illegible]
Secchi, In.		[illegible]
Depth, F.		[illegible]
Station		[illegible]

[illegible]
[illegible]
AND LOWER SAN FRANCISCO BAY - 1975

pH	AUGUST, 1975	[illegible]
DO Mg/l		[illegible]
DO Mg/l		[illegible]
Temp., C		[illegible]
Secchi, In.		[illegible]
Depth, Ft.		[illegible]
pH	JULY, 1975	[illegible]
DO Mg/l		[illegible]
DO Mg/l		[illegible]
Temp., C		[illegible]
Secchi, In.		[illegible]
Depth, Ft.		[illegible]
pH	[illegible], 1975	[illegible]
DO Mg/l		[illegible]
DO Mg/l		[illegible]
Temp., C		[illegible]
Secchi, In.		[illegible]
Depth, Ft.		[illegible]
pH	MAY, 1975	[illegible]
DO Mg/l		[illegible]
DO Mg/l		[illegible]
Temp., C		[illegible]
Secchi, In.		[illegible]
Depth, Ft.		[illegible]
Station		[illegible]

MONITORING PROGRAM DATA
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1975



MONITORING PROGRAM DATA
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1976

STATION		C_1		C_2		C_3		C_4		C_5		C_6		C_7		C_8		C_9	
pH	APRIL 1976	7.3	-	7.2	-	7.3	-	7.3	-	7.4	-	7.4	-	7.7	-	7.6	-	7.7	-
DS, mg/l		0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
DO, mg/l		6.7	-	5.2	-	4.2	-	3.8	-	3.7	-	3.0	-	5.9	-	5.3	-	6.9	-
Temp, °C		22	-	20	-	18	-	16	-	20	-	15	-	14	-	14	-	14	-
Secchi, In.		18	-	11	-	10	-	8	-	10	-	8	-	8	-	8	-	12	-
Depth, Ft.		2.0	-	-	-	-	-	4.6	-	-	-	-	-	-	-	14.6	-	-	-
pH	MARCH 1976	7.3	8.4	7.5	7.4	7.6	7.9	7.6	7.5	7.7	7.5	8.0	7.6	8.0	7.9	8.0	7.8	8.1	8.0
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		4.9	6.1	4.8	5.7	4.9	5.1	5.5	3.6	6.3	3.0	8.9	4.2	9.0	5.8	9.2	5.3	9.2	7.7
Temp. °C		21	23	16	22	18	22	14	17	14	17	14	18	14	15	13	16	13	16
Secchi, In		16	13	13	10	12	8	15	4	18	7	27	8	27	10	30	7	38	9
Depth, Ft.		6.1	5.9	-	-	-	-	14.0	4.8	-	-	-	-	-	-	14.6	14.6	-	-
pH	FEBRUARY 1976	7.3	7.3	7.5	7.4	7.5	7.4	7.6	7.5	7.7	7.6	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		2.9	4.6	4.6	3.8	4.7	4.1	6.5	5.1	6.4	5.9	7.1	6.9	7.8	7.7	7.7	8.1	8.0	8.3
Temp., °C		20	22	13	18	12	16	11	15	11	14	10	14	10	13	10	14	10	13
Secchi, In.		17	9	18	8	13	9	15	10	18	12	18	13	20	16	24	20	30	30
Depth, Ft.		6.8	5.2	-	-	-	-	10.0	9.4	-	-	-	-	-	-	15.0	19	-	-
pH	JANUARY 1976	7.4	7.5	7.4	7.4	7.4	7.4	7.5	7.4	7.5	7.4	7.5	7.4	7.6	7.5	7.6	7.4	7.6	7.5
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		6.7	6.8	5.1	4.5	3.5	4.3	3.8	2.7	8.9	2.6	4.5	3.3	5.1	4.2	5.5	4.3	6.5	5.7
Temp. °C		21	21	20	19	19	19	14	15	12	14	11	12	9	11	10	11	9	10
Secchi, In.		18	18	8	8	8	7	9	4	10	9	10	8	11	11	13	7	19	12
Depth, Ft.		4.0	3.4	-	-	-	-	4.8	4.0	-	-	-	-	-	-	15.0	15.0	-	-

MONITORING PHYSICAL DATA
FOR STATIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1976

	STATION	C₁		C₂		C₃		C₄		C₅		C₆		C₇		C₈		C₉	
AUGUST 1976	pH	7.6	7.5	7.5	7.5	7.5	7.5	7.7	7.5	7.6	7.5	7.6	7.7	7.7	7.7	7.6	7.7	7.6	7.7
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	5.9	4.1	3.6	1.5	3.6	1.2	9.6	1.2	5.2	1.9	3.5	4.2	1.5	4.5	1.7	5.5	1.8	6.0
	Temp, °C	27	26	21	24	26	21	23	20	23	20	23	17	22	19	22	15	22	20
	Secchi, In.	12	9	6	9	6	9	6	15	6	21	6	24	10	36	8	36	12	36
	Depth, Ft	3.6	4.9	-	-	-	-	3.2	9.8	-	-	-	-	-	-	13	11.8	-	-
JULY 1976	pH	7.3	7.0	7.4	7.8	7.4	7.7	7.5	7.6	7.6	7.7	7.5	7.8	7.6	7.8	7.5	7.8	7.5	7.9
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	5.1	0.0	2.0	11.7	2.1	4.3	6.8	2.6	7.7	2.9	4.4	4.7	2.3	5.1	2.1	5.7	2.5	6.1
	Temp, °C	28	26	26	24	26	22	24	22	24	22	24	22	23	22	23	22	23	22
	Secchi, In.	14	28	3	12	2	12	4	8	4	10	6	20	8	28	6	30	16	42
	Depth, Ft.	3.6	4.8	-	-	-	-	2	9.8	-	-	-	-	-	-	8	11.8	-	-
JUNE 1976	pH	7.2	7.3	7.1	7.6	7.2	7.6	7.3	7.6	7.4	7.6	7.5	7.8	7.7	7.8	7.6	8.0	7.7	8.1
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	6.7	4.5	3.1	8.5	3.2	3.8	4.3	3.3	5.2	3.2	5.1	5.0	5.1	5.6	4.8	6.5	5.3	7.9
	Temp, °C	24	21	22	21	22	20	20	23	20	19	18	21	16	19	18	20	18	20
	Secchi, In.	18	20	8	8	6	10	4	11	6	12	6	15	12	20	8	30	10	36
	Depth, Ft	3.4	4.8	-	-	-	-	5.2	9.8	-	-	-	-	-	-	12	[illegible]	-	-
MAY 1976	pH	7.4	7.3	7.4	7.3	7.3	7.9	7.4	7.6	7.5	7.6	7.5	7.6	7.7	7.6	7.6	7.7	7.6	7.8
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	6.3	4.7	5.1	3.3	4.1	3.1	2.9	3.6	3.4	4.9	5.5	4.8	4.9	5.5	4.2	5.4	5.1	6.0
	Temp, °C	24	19	22	18	22	21	22	17	19	18	20	17	19	17	19	18	19	17
	Secchi, In	18	22	10	12	10	12	6	12	12	12	12	10	12	16	6	18	10	20
	Depth, Ft	5.3	4.2	-	-	-	-	-	9	-	-	-	-	-	-	-	19	-	-

MONITORING PHYSICAL DATA
FOR STATIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1976

	STATION	C₁		C₂		C₃		C₄		C₅		C₆		C₇		C₈		C₉	
DECEMBER 1976	pH	7.4	7.4	7.4	7.5	7.5	7.4	7.5	7.9	7.5	7.4	7.7	7.4	7.7	7.5	7.8	7.6	7.7	7.6
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	3.4	6.5	2.5	6.1	3.2	4.1	4.1	2.1	4.5	1.9	5.6	2.2	6.1	3.3	6.6	3.4	6.9	4.3
	Temp, °C	21	22	14	22	11	21	11	15	11	14	11	14	11	12	11	12	11	12
	Secchi, In.	12	12	9	15	12	12	18	12	18	12	24	12	24	18	27	18	33	18
	Depth, Ft	7	-	-	-	-	-	9	-	-	-	-	-	-	-	23	-	-	-
NOVEMBER 1976	pH	7.5	7.5	7.4	7.5	7.4	7.5	7.4	7.4	7.4	7.5	7.6	7.5	7.6	7.5	7.6	7.6	7.8	7.7
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	5.5	6.6	1.9	6.0	7.3	5.1	0.8	3.4	1.5	3.5	2.1	4.1	3.6	6.2	4.4	4.9	6.2	4.5
	Temp, °C	24	23	22	23	19	22	18	13	19	14	18	13	17	12	17	14	17	13
	Secchi, In	18	12	9	9	12	12	6	12	12	9	15	12	24	15	24	15	36	30
	Depth, Ft	3.4	4.5	-	-	-	-	4.0	-	-	-	-	-	-	-	18	17.0	-	-
OCTOBER 1976	pH	7.2	-	7.2	-	7.2	-	7.2	-	7.2	-	7.3	-	7.4	-	7.4	-	7.5	-
	DS, mg/l	0	-	0	-	0	-	-	-	0	-	0	-	0	-	0	-	0	-
	DO, mg/l	5.6	-	2.5	-	2.2	-	2.1	-	1.4	-	1.9	-	2.1	-	2.4	-	3.3	-
	Temp, °C	26	-	25	-	24	-	22	-	21	-	21	-	21	-	20	-	20	-
	Secchi, In	14	-	10	-	8	-	10	-	10	-	14	-	24	-	24	-	30	-
	Depth, Ft	3.6	-	-	-	-	-	6.0	-	-	-	-	-	-	-	[illegible]	-	-	-
SEPTEMBER 1976	pH	7.9	7.3	7.4	7.3	7.4	7.3	7.5	7.4	7.5	7.4	7.6	7.4	7.6	7.5	7.7	7.6	7.8	7.5
	DS, mg/l	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DO, mg/l	4.6	5.7	3.8	3.7	2.9	7.7	2.9	1.1	1.7	1.1	3.6	1.6	4.0	1.2	4.3	1.7	5.9	2.5
	Temp, °C	21	27	24	26	22	22	20	22	20	22	19	20	20	20	20	17	21	19
	Secchi, In.	20	24	12	12	8	10	12	6	16	14	20	14	26	18	34	18	42	20
	Depth, Ft	5.0	4.0	-	-	-	-	9.8	6.0	-	-	-	-	-	-	12.0	17.0	-	-

[illegible]
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1977

		C_1		C_2		C_3		C_4		C_5		C_6		C_7		C_8		C_9	
pH	APRIL 1977	7.4	7.5	7.5	7.5	7.6	7.4	7.7	7.5	7.8	7.5	7.8	7.5	7.8	7.6	7.6	7.6	7.9	7.7
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		4.3	6.3	2.9	4.5	3.5	2.7	6.1	2.0	4.7	1.7	5.5	2.1	6.5	3.6	7.0	4.5	6.5	5.3
TEMP. °C		18	24	19	22	19	22	19	19	19	19	19	18	20	18	20	18	20	17
SECCHI, IN.		12	15	9	6	12	6	12	6	18	6	15	6	21	9	24	12	27	9
DEPTH, FT.		5.5	1.5	---	---	---	---	7.5	4.5	---	---	---	---	---	---	21	16	---	---
pH	MARCH 1977	7.3	7.6	7.3	7.6	7.3	7.6	7.4	7.7	7.4	7.8	7.4	7.8	7.5	8.0	7.5	8.0	7.7	8.0
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		1	5.4	3.7	4.3	3.8	4.1	2.3	4.9	1.9	6.5	1.9	7.1	3.5	2.3	3.6	8.1	5.9	6.3
TEMP. °C		21	20	21	17	20	15	15	14	16	14	16	13	14	12	14	12	14	12
SECCHI, IN.		18	15	6	12	6	12	6	15	9	15	9	12	9	15	12	18	15	24
DEPTH, FT.		2.5	6	---	---	---	---	[illegible]	9	---	---	---	---	---	---	15	20	---	---
pH	FEBRUARY 1977	---	7.5	---	7.4	---	7.4	---	7.5	---	7.4	---	7.3	---	7.5	---	7.6	---	7.7
DS, mg/l		---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0
DO, mg/l		---	6.3	---	5.1	---	4.2	---	2.8	---	2.4	---	2.9	---	4.3	---	4.3	---	6.1
TEMP., °C		---	22	---	21	---	20	---	16	---	16	---	15	---	14	---	14	---	14
SECCHI, IN.		---	12	---	6	---	9	---	9	---	9	---	12	---	12	---	15	---	15
DEPTH, FT.		---	2	---	---	---	---	---	---	---	---	---	---	---	---	---	11	---	---
pH	JANUARY 1977	7.4	7.4	7.4	7.7	7.4	7.6	7.5	7.4	7.5	7.5	7.6	7.4	7.7	7.5	7.7	7.5	7.8	7.6
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		5.7	6.3	4.1	6.2	4.2	4.7	1.4	2.5	6.6	2.1	5.9	3.9	6.7	3.9	7.3	4.5	7.5	6.4
TEMP. °C		17	21	17	21	10	21	8	16	7	14	6	13	6	12	6	12	6	11
SECCHI, IN.		18	21	12	9	9	12	6	12	9	12	17	12	12	15	18	12	21	18
DEPTH, FT.		5.5	2.5	---	---	---	---	15	6.0	---	---	---	---	---	---	14	17	---	---

[illegible]
FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1977

		C_1		C_2		C_3		C_4		C_5		C_6		C_7		C_8		C_9	
pH	AUGUST 1977	7.5	7.5	7.3	7.6	7.5	7.7	7.6	7.7	7.5	7.7	7.6	7.8	7.5	7.9	7.5	7.9	7.6	7.9
DS, mg/l		---	0	0	0	0	0	---	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		5.9	4.7	4.3	2.0	2.5	3.6	6.4	3.6	3.8	3.6	3.4	4.4	1.8	5.1	1.6	5.3	2.8	6.3
TEMP. °C		26	27	26	23	26	22	24	22	26	21	26	21	25	21	25	21	24	21
SECCHI, IN.		12	18	3	9	3	9	5	12	9	12	15	24	12	24	15	30	12	42
DEPTH, FT.		3.5	6	---	---	---	---	4.0	11	---	---	---	---	---	---	15	21	---	---
pH	JULY 1977	7.8	7.5	7.8	7.5	7.7	7.6	7.6	7.7	7.6	7.7	7.7	7.8	7.7	7.7	7.7	7.9	7.7	7.8
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		3.2	6.8	2.4	6.0	2.2	5.5	2.7	5.0	2.3	5.4	3.4	6.2	4.0	8.2	3.9	9.5	4.7	6.5
TEMP. °C		25	26	22	25	21	25	21	23	20	23	20	23	19	22	19	22	19	21
SECCHI, IN.		42	12	12	6	9	6	9	6	9	6	12	6	18	12	18	12	24	12
DEPTH, FT.		3.5	3.5	---	---	---	---	4.0	4.0	---	---	---	---	---	---	17	15	---	---
pH	JUNE 1977	7.3	7.5	7.3	7.4	7.4	7.5	7.4	7.6	7.5	7.7	7.5	7.6	7.5	7.6	7.6	7.6	7.6	7.7
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		5.2	8.1	3.1	6.0	2.5	4.1	2.7	2.2	3.5	3.4	4.0	4.4	4.7	3.5	4.8	7.5	6.5	5.4
TEMP. °C		24	24	22	24	22	23	21	21	21	21	20	19	20	20	20	20	20	19
SECCHI, IN.		30	---	12	6	12	6	9	6	9	6	12	6	15	9	15	12	18	12
DEPTH, FT.		4.5	3.5	---	---	---		---	16.5	---	---	---	---	---	---	19	---	---	---
pH	MAY 1977	7.3	7.5	7.4	7.6	7.4	7.5	7.5	7.5	7.7	7.5	7.7	7.6	7.7	7.7	7.8	7.6	7.8	7.7
DS, mg/l		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO, mg/l		5.3	6.0	3.1	6.0	2.9	4.5	2.9	3.0	3.4	3.5	4.5	4.5	5.5	5.5	5.2	4.6	6.5	5.9
TEMP. °C		22	23	18	22	17	21	15	16	15	17	15	16	15	15	14	14	15	15
SECCHI, IN.		24	18	9	6	9	6	9	6	12	6	12	6	18	6	21	9	24	9
DEPTH, FT.		5	2.5	---	---	---	---	20	15	---	---	---	---	---	---	9	4.5	---	---

FOR PORTIONS OF COYOTE CREEK ESTUARY
AND SOUTH SAN FRANCISCO BAY - 1977

		C1		C2		C3		C4		C5		C6		C7		C8		C9	
pH	DECEMBER 1977	7.1	7.3	7.1	7.3	7.1	7.3	7.2	7.3	7.3	7.3	7.5	7.4	7.5	7.4	7.6	7.5	7.7	7.7
DS, mg/l		---	---	0	0	0	0	0	0	0	0	0	0	0	0	0	---	---	---
DO, mg/l		5.3	6.0	1.2	4.6	0.1	4.0	0.6	2.5	1.3	2.6	3.5	3.3	3.9	4.4	4.9	5.3	5.8	6.7
TEMP. °C		23	22	20	20	18	19	16	14	15	14	15	13	14	12	14	12	14	12
SECCHI, IN.		---	9	---	6	---	6	---	6	---	6	---	6	---	12	---	18	---	24
DEPTH, FT.		4.5	2.5	---	---	---	---	8.0	6.0	---	---	---	---	---	---	19	17	---	---
pH	NOVEMBER 1977	7.2	7.2	7.2	7.4	7.2	7.6	7.3	7.6	7.4	7.7	7.4	7.7	7.5	7.7	7.5	7.7	7.7	7.8
DS, mg/l		---	---	---	---	0	---	0	---	0	---	0	---	0	---	0	---	---	---
DO, mg/l		6.2	5.5	5.0	5.4	4.3	6.2	3.3	6.8	3.2	7.1	3.3	7.8	4.2	7.6	4.3	7.7	5.9	7.6
TEMP. °C		25	23	24	17	22	12	18	12	18	12	19	12	17	12	17	12	17	12
SECCHI, IN.		12	12	6	6	6	6	9	6	6	6	9	9	12	15	12	18	18	24
DEPTH, FT.		3.0	7.5	---	---	---	---	12	---	---	---	---	---	---	---	18	23	---	---
pH	OCTOBER 1977	7.4	7.3	7.4	7.4	7.5	7.4	7.5	7.5	7.5	7.5	7.5	7.6	7.6	7.7	7.6	7.7	7.6	7.8
DS, mg/l		---	---	---	0	---	0	0	0	0	0	0	0	0	---	0	---	0	---
DO, mg/l		5.9	5.2	5.2	1.2	6.1	1.7	2.5	2.1	3.9	3.3	3.4	4.7	3.7	5.3	3.6	5.5	4.1	6.4
TEMP. °C		26	23	26	18	25	17	23	17	22	17	22	17	22	17	21	17	20	17
SECCHI, IN.		18	9	12	6	6	6	9	12	9	12	12	18	18	22	18	24	24	30
DEPTH, FT.		3.5	7.0	---	---	---	---	8.0	12	---	---	---	---	---	---	18	22	---	---
pH	SEPTEMBER 1977	7.8	7.6	7.7	7.6	7.6	7.5	7.7	7.6	7.8	7.6	7.6	7.6	7.6	7.7	7.6	7.7	7.6	7.8
DS, mg/l		---	0	---	0	---	0	---	0	---	0	0	0	0	0	0	0	0	0
DO, mg/l		6.0	4.6	5.3	0.9	4.0	0.9	6.8	1.3	9.7	1.5	3.0	2.3	3.3	2.6	2.8	3.5	2.3	4.0
TEMP. °C		28	26	28	21	26	18	24	19	23	18	22	21	21	19	21	20	21	19
SECCHI, IN.		15	21	6	6	6	12	6	15	6	18	9	18	21	24	18	36	24	48
DEPTH, FT.		3.5	6	---	---	---	---	8.5	11	---	---	---	---	---	---	19	21	---	---

THE PORTER-COLOGNE WATER QUALITY CONTROL ACT

And Related Code Sections
(Including 1973 Amendments)

JULY 1974

California State Water Resources Control Board

STATE OF CALIFORNIA
RONALD REAGAN
Governor

THE RESOURCES AGENCY

STATE WATER RESOURCES CONTROL BOARD

The State Water Resources Control Board was established by the 1967 Legislature (Stats. 1967, Chap. 284). The Board is divided into two statutory divisions: Water Rights and Water Quality, each with a division chief. In addition, a Legal Division and Divisions of Planning and Research and Administrative Services have been established.

The Board succeeded to the functions of the former State Water Rights Board and the State Water Quality Control Board, which were abolished. The formation of the Board resulted in the coordination of the water rights, water pollution, and water quality functions of the State Government. Water pollution and water quality are now taken into account in conjunction with availability of unappropriated water whenever applications for appropriation of water are considered.

The Board may represent state or local agencies in any matters involving the Federal Government which are within the scope of its powers and duties.

W. W. ADAMS, *Chairman*
RONALD B. ROBIE, *Vice Chairman*
ROY E. DODSON, JR.
MRS. CARL H. (JEAN) AUER
W. DON MAUGHAN
BILL B. DENDY, *Executive Officer*

Regional Water Quality Control Boards

The State is divided into nine regions, each with a regional board composed of nine members appointed by the Governor for terms of four years. The boards are authorized to adopt regional water quality control plans, prescribe waste discharge requirements, and perform other functions concerning water quality control within their respective regions, subject to State Board review or approval.

This pamphlet contains only those portions of the Water Code which concern the organization of the State Board, water quantity-quality relationships, water reclamation and ground water investigations by the Department of Water Resources (an independent agency), and water quality control. Administration by the State Board of water rights and statutory procedures for the determination of water rights are covered in other parts of the Water Code and are explained in other publications of the Board.

WATER QUANTITY AND QUALITY RELATIONSHIPS

1242.5. The board, subject to the provisions of Section 100 and whenever it is in the public interest, may approve appropriation by storage of water to be released for the purpose of protecting or enhancing the quality of other waters which are put to beneficial uses.

(Added by Stats. 1969, Ch. 482.)

1243. The use of water for recreation and preservation and enhancement of fish and wildlife resources is a beneficial use of water. In determining the amount of water available for appropriation for other beneficial uses, the board shall take into account, whenever it is in the public interest, the amounts of water required for recreation and the preservation and enhancement of fish and wildlife resources.

The board shall notify the Department of Fish and Game of any application for a permit to appropriate water. The Department of Fish and Game shall recommend the amounts of water, if any, required for the preservation and enhancement of fish and wildlife resources and shall report its findings to the board.

This section shall not be construed to affect riparian rights.

(Added by Stats. 1959, Ch. 2048; amended by Stats. 1967, Ch. 284, and Stats. 1972, Ch. 360.)

1243.5. In determining the amount of water available for appropriation, the board shall take into account, whenever it is in the public interest, the amounts of water needed to remain in the source for protection of beneficial uses, including any uses specified to be protected in any relevant water quality control plan established pursuant to Division 7 (commencing with Section 13000) of this code.

This section shall not be construed to affect riparian rights.

(Added by Stats. 1969, Ch. 482.)

1257. In acting upon applications to appropriate water, the board shall consider the relative benefit to be derived from (1) all beneficial uses of the water concerned including, but not limited to, use for domestic, irrigation, municipal, industrial, preservation and enhancement of fish and wildlife, recreational, mining and power purposes, and any uses specified to be protected in any relevant water quality control plan, and (2) the reuse or reclamation of the water sought to be appropriated, as proposed by the applicant. The board may subject such appropriations to such terms and conditions as in its judgment will best develop, conserve, and utilize in the public interest, the water sought to be appropriated.

(Added by Stats. 1955; amended by Stats. 1957, Ch. 1932 and Ch. 2082, Stats. 1959, Ch. 2048, Stats. 1969, Ch. 482, and by Stats. 1970, Ch. 157.)

1258. In acting upon applications to appropriate water, the board shall consider water quality control plans which have been established pursuant to Division 7 (commencing with Section 13000) of this code, and may subject such appropriations to such terms and conditions as it finds are necessary to carry out such plans.

(Added by Stats. 1967, Ch. 284 and amended by Stats. 1969, Ch. 482.)

ADJUDICATIONS TO PROTECT GROUND WATER QUALITY

DIVISION 2, PART 3

CHAPTER 2.5. ADJUDICATIONS TO PROTECT THE QUALITY OF GROUND WATER

(Added by Stats. 1969, Ch. 482.)

2100. After the department [of water resources] has submitted to the board recommendations for the protection of the quality of ground water pursuant to Section 12617.1 or 12923.1 of this code, or in reliance upon investigation by any governmental agency, the board may file an action in the superior court to restrict pumping, or to impose physical solutions, or both, to the extent necessary to prevent destruction of or irreparable injury to the quality of such water. In such action, all of the claimants to the use of the affected water known to the board, except claimants to the use of minor quantities of water as defined in Section 2102, shall be named as defendants. In any watershed or ground water basin wherein (a) all or substantially all of the rights to water have been adjudicated and the court has retained continuing jurisdiction arising from the adjudication, or (b) wherein such action is pending, any such proceedings by the board shall be undertaken only by intervention by the board in such existing action.

2101. (a) Before filing or intervening in any such action the board shall hold a public hearing on the necessity for restricting ground water pumping or for a physical solution in order to protect the quality of water from destruction or irreparable injury. The board shall serve notice of such hearing as provided in Section 6066 of the Government Code and shall mail a copy of such notice to each producer of ground water within the area proposed for investigation, to the extent that such producers of ground water are known to the board, at least 15 days prior to the date of such hearing, except that notice need not be mailed to producers of minor quantities of water as defined in Section 2102.

(b) In the event the board decides that the rights to the use of the ground water must be adjudicated in order to require the restriction of pumping or physical solution necessary to preserve it from destruction or irreparable injury to quality, the board shall first determine whether any local public agency overlying all or a part of the ground water basin will undertake such adjudication of water rights. If such local agency commences an adjudication, the board shall take no further action, except that the board may, through the Attorney General, become a party to such action.

(c) In the event no local agency commences such action within 90 days after notice of the decision of the board, the board shall file such action.

2102. As used in this article, "minor quantities of water" refers to the extraction by any person of not to exceed 10 acre-feet of ground water annually.

230. The department, either independently or in cooperation with any person or any county, state, federal, or other agency, or upon the request of the State Water Resources Control Board, to the extent funds are allocated therefor, shall conduct surveys and investigations relating to the reclamation of water from wastes for beneficial purposes, including but not limited to the determination of quantities of such water presently wasted, and possibilities of use of such water for recharge of underground storage or for agricultural or industrial uses; and shall report to the Legislature and to the appropriate California regional water quality control board thereon, annually.

(Added by Stats. 1949, Ch. 1552; amended by Stats. 1967, Ch. 1446 and Ch. 1447, and by Stats. 1969, Ch. 482.)

231. The department, either independently or in cooperation with any person or any county, state, federal or other agency, shall investigate and survey conditions of damage to quality of underground waters, which conditions are or may be caused by improperly constructed, abandoned or defective wells through the interconnection of strata or the introduction of surface waters into underground waters. The department shall report to the appropriate California regional water quality control board its recommendations for minimum standards of well construction in any particular locality in which it deems regulation necessary to protection of quality of underground water, and shall report to the Legislature from time to time, its recommendations for proper sealing of abandoned wells.

(Added by Stats. 1949, Ch. 1552; amended by Stats. 1969, Ch. 482.)

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12617.1. The department, in making investigations and plans for water projects and for the solution of the water problems of the state pursuant to Sections 12616 and 12617, shall include plans and recommendations for the protection of the quality of the waters affected, including downstream waters, with respect to all sources of impairment and factors affecting quality. In doing so, the department shall cooperate with counties, cities, state agencies, and public districts to the end that planning for water quality control shall be coordinated to the maximum extent possible. Such plans and recommendations shall be transmitted to the State Water Resources Control Board and to the appropriate California regional water quality control boards for their consideration in the adoption of state policy for water quality control, water quality control plans, and waste discharge requirements.

(Added by Stats. 1969, Ch. 482.)

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12923.1. The results of the investigations and studies conducted and the plans and design criteria developed by the department pursuant to this article shall be transmitted to the State Water Resources Control Board and to the appropriate California regional water quality control boards for their consideration in the adoption of state policy for water quality control, water quality control plans and waste discharge requirements.

(Added by Stats. 1969, Ch. 482.)

DIVISION 7. WATER QUALITY

(Former Division 7 repealed by Stats. 1969, Ch. 482 which added Division 7 commencing with Section 13000.)

CHAPTER 1. POLICY

13000. The Legislature finds and declares that the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state.

The Legislature further finds and declares that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.

The Legislature further finds and declares that the health, safety and welfare of the people of the state requires that there be a statewide program for the control of the quality of all the waters of the state; that the state must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the state from degradation originating inside or outside the boundaries of the state; that the waters of the state are increasingly influenced by interbasin water development projects and other statewide considerations; that factors of precipitation, topography, population, recreation, agriculture, industry and economic development vary from region to region within the state; and that the statewide program for water quality control can be most effectively administered regionally, within a framework of statewide coordination and policy.

13001. It is the intent of the Legislature that the state board and each regional board shall be the principal state agencies with primary responsibility for the coordination and control of water quality. The state board and regional boards in exercising any power granted in this division shall conform to and implement the policies of this chapter and shall, at all times, coordinate their respective activities so as to achieve a unified and effective water quality control program in this state.

13002. No provision of this division or any ruling of the state board or a regional board is a limitation:

(a) On the power of a city or county or city and county to adopt and enforce additional regulations, not in conflict therewith, imposing further conditions, restrictions, or limitations with respect to the disposal of waste or any other activity which might degrade the quality of the waters of the state.

(b) On the power of any city or county or city and county to declare, prohibit, and abate nuisances.

(c) On the power of the Attorney General, at the request of a regional board, the state board, or upon his own motion, to bring an action in the name of the people of the State of California to enjoin any pollution or nuisance.

(d) On the power of a state agency in the enforcement or administration of any provision of law which it is specifically permitted or required to enforce or administer.

(e) On the right of any person to maintain at any time any appropriate action for relief against any private nuisance as defined in the Civil Code or for relief against any contamination or pollution.

Chapter 1.5. Short Title

13020. This division shall be known and may be cited as the Porter-Cologne Water Quality Control Act.

Chapter 2. Definitions

13050. As used in this division:

(a) "State board" means the State Water Resources Control Board.

(b) "Regional board" means any California regional water quality control board for a region as specified in Section 13200.

(c) "Person" also includes any city, county, district, the state or any department or agency thereof. "Person" includes the United States, to the extent authorized by federal law.

(d) "Waste" includes sewage and any all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation of whatever nature, including such waste placed within containers of whatever nature prior to, and for purposes of, disposal.

(Amended by Stats. 1970, Ch. 202.)

NOTE. The Porter-Cologne Act provides that it is intended to implement the legislative recommendations* in a report of the State Water Resources Control Board to the Legislature which in turn contains a note that the definition of waste is intended to include all interpretations of the Attorney General of "sewage", "industrial waste", and "other waste" under the former act. These terms were interpreted to include all of the following:

1. Drainage from inoperative and abandoned mines. 26 Ops. Cal. Atty. Gen. 88; see also 37 Ops. Cal. Atty. Gen. 163.
2. Drainage, flow or seepage containing debris or eroded earth from logging operations; waste materials in dumps; drainage from agricultural operations; liquids from a stratum intercepted by a well which flows through the well into another stratum. 27 Ops. Cal. Atty. Gen. 182.
3. Discharge of water from a hydroelectric plant. 43 Ops. Cal. Atty. Gen. 302.
4. Changes in the physical or chemical characteristics of receiving waters caused by extraction of sand, gravel or other materials from a streambed. 32 Ops. Cal. Atty. Gen. 139.
5. Waste from construction operations, dumped in waters of the state. 16 Ops. Cal. Atty. Gen. 125.

(e) "Waters of the state" means any water, surface or underground, including saline waters, within the boundaries of the state.

(f) "Beneficial uses" of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

(g) "Quality of the water" or "quality of the waters" refers to chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect its use.

(h) "Water quality objectives" means the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.

(i) "Water quality control" means the regulation of any activity or factor which may affect the quality of the waters of the state and includes the prevention and correction of water pollution and nuisance.

(j) "Water quality control plan" consists of a designation or establishment for the waters within a specified area of (1) beneficial uses to be protected, (2) water quality objectives, and (3) a program of implementation needed for achieving water quality objectives.

(k) "Contamination" means an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" shall include any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.

(*l*) "Pollution" means an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects: (1) such waters for beneficial uses, or (2) facilities which serve such beneficial uses. "Pollution" may include "contamination."

(m) "Nuisance" means anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes.

(n) "Reclaimed water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

(o) "Citizen or domiciliary" of the State of California includes a foreign corporation having substantial business contacts in the State of California or which is subject to service of process in this state.

(Amended by Stats. 1969, Ch. 800.)

Chapter 3. State Water Quality Control

Article 1. State Water Resources Control Board

13100. There is in the Resources Agency the State Water Resources Control Board, the Water Quality Advisory Committee, and the California regional water quality control boards. The organization, membership, and some of the duties of the state board are provided for in Article 3 (commencing with Section 174) of Chapter 2 of Division 1 of this code.

Article 2. Water Quality Advisory Committee

(Added by Stats. 1969, Ch. 482. Repealed by Stats. 1972, Ch. 813.)

Article 3. State Policy for Water Quality Control

13140. The state board shall formulate and adopt state policy for water quality control. Such policy shall be adopted in accordance with

the provisions of this article and shall be in conformity with the policies set forth in Chapter 1 (commencing with Section 13000).

13141. State policy for water quality control adopted or revised in accordance with the provisions of this article, and regional water quality control plans approved or revised in accordance with Section 13245, shall become a part of the California Water Plan effective when such state policy for water quality control, and such regional water quality control plans have been reported to the Legislature at any session thereof.

13142. State policy for water quality control shall consist of all or any of the following:

(a) Water quality principles and guidelines for long-range resource planning, including ground water and surface water management programs and control and use of reclaimed water.

(b) Water quality objectives at key locations for planning and operation of water resource development projects and for water quality control activities.

(c) Other principles and guidelines deemed essential by the state board for water quality control. (Amended by Stats. 1971, Ch. 1288).

13143. State policy for water quality control shall be periodically reviewed and may be revised.

13144. During the process of formulating or revising state policy for water quality control the state board shall consult with and carefully evaluate the recommendations of concerned federal, state, and local agencies.

13145. The state board shall take into consideration the effect of its actions pursuant to this chapter on the California Water Plan as adopted or revised pursuant to Division 6 (commencing with Section 10000) of this code, and on any other general or coordinated governmental plan looking toward the development, utilization, or conservation of the waters of the state.

13146. State offices, departments and boards, in carrying out activities which affect water quality, shall comply with state policy for water quality control unless otherwise directed or authorized by statute, in which case they shall indicate to the state board in writing their authority for not complying with such policy.

13147. The state board shall not adopt state policy for water quality control unless a public hearing is first held respecting the adoption of such policy. At least 60 days in advance of such hearing the state board shall notify any affected regional boards, unless notice is waived by such boards, and shall give notice of such hearing by publication within the affected region pursuant to Section 6061 of the Government Code. The regional boards shall submit written recommendations to the state board at least 20 days in advance of the hearing. (Amended by Stats. 1971, Ch. 1288).

Article 4. Other Powers and Duties of the State Board

13160. The state board is designated as the state water pollution control agency for all purposes stated in the Federal Water Pollution Control Act and any other federal act, heretofore or hereafter enacted, and is (a) authorized to give any certificate or statement required by any federal agency pursuant to any such federal act that there is reasonable assurance that an activity of any person subject to the jurisdiction of the state board will not reduce water quality below applicable standards, and (b) authorized to exercise any powers delegated to the state by the Federal Water Pollution Control Act (33 U.S.C. 466, et seq.) and acts amendatory thereto. (Amended by Stats. 1971, Ch. 1288).

13160.1. The state board may establish a reasonable fee schedule to cover the cost of giving any certificate which is required or authorized by any federal law with respect to the effect of any existing or proposed facility, project, or construction work upon the quality of waters of the state, including certificates requested by applicants for a federal permit or license pursuant to subdivision (b) of Section 21 of the Federal Water Pollution Control Act and certificates requested pursuant to Section 169 of the Internal Revenue Code, as amended in 1969, with respect to water pollution control facilities. (Added by Stats. 1971, Ch. 1288).

13161. The state board shall annually determine state needs for water quality research and recommend projects to be conducted.

13162. The state board shall administer any statewide program of research in the technical phases of water quality control which may be delegated to it by law and may accept funds from the United States or any person to that end. The state board may conduct such a program independently, or by contract or in cooperation with any federal or state agency, including any political subdivision of the state, or any person or public or private organization.

13163. (a) The state board shall coordinate water-quality-related investigations of state agencies, recognizing that other state agencies have primary statutory authority for such investigations, and shall consult with the concerned regional boards in implementing this section.

(b) The state board from time to time shall evaluate the need for water-quality-related investigations to effectively develop and implement statewide policy for water quality control and shall transmit its recommendations for investigations to affected or concerned federal, state, and local agencies. The affected state agencies shall comply with the recommendations or shall advise the state board in writing why they do not comply with such recommendations.

(c) State agencies shall submit to the state board plans for and results of all investigations that relate to or have an effect upon water quality for review and comment.

13164. The state board shall formulate, adopt and revise general procedures for the formulation, adoption and implementation by regional boards of water quality control plans. During the process of formulating or revising such procedures, the state board shall consult with an evaluate the recommendations of any affected regional boards. (Amended by Stats. 1972, Ch. 813.)

13165. The state board may require any state or local agency to investigate and report on any technical factors involved in water quality control; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained therefrom.

13166. The state board, with the assistance of the regional boards, shall prepare and implement a statewide water quality information storage and retrieval program. Such program shall be coordinated and integrated to the maximum extent practicable with data storage and retrieval programs of other agencies.

13167. The state board shall implement a public information program on matters involving water quality, and shall maintain an information file on water quality research and other pertinent matters.

13168. The state board shall allocate to the regional boards from funds appropriated to the state board such part thereof as may be necessary for the administrative expenses of such boards. The regional boards shall submit annual budgets to the state board. Subject to the provisions of Chapter 3 (commencing with Section 13291) of Part 3, Division 3, Title 2 of the Government Code and any other laws giving the Department of Finance fiscal and budgetary control over state departments generally, the state board shall prepare an annual budget concerning its activities and the activities of the regional boards.

13169. (a) The state board may adopt regulations governing the testing, licensing and use of any chemical, or any other substance, for removing, dispersing or otherwise cleaning up oil or any residuary product of petroleum in or on any of the waters of the state. Such regulations shall be adopted in conformity, as nearly as practicable, with the provisions of Chapter 4.5 (commencing with Section 11371), Part 1, Division 3, Title 2 of the Government Code.

(b) The state board may establish a schedule of fees to cover the cost of testing and licensing the use of any substance for the purposes specified in subdivision (a), to be paid by the applicant for licensing of any such substance.

(c) The proper use of any such substance in accordance with the state board's regulations shall be supervised and enforced by the Department of Fish and Game. The user shall pay to the Department of Fish and Game the cost of such supervisory and enforcement services and all related administrative and incidental costs, as computed by that department, within 30 days after billing. Deputies of the Department of Fish and Game shall have all the powers and authority of a peace officer to make arrests for violations of regulations adopted by the state board pursuant to this section.

(d) Any person who uses any chemical or other substance in violation of any regulation adopted by the state board pursuant to this section shall be guilty of a misdemeanor. Each day's continuance of such violation shall constitute a separate offense.

13170. The state board may adopt water quality control plans in accordance with the provisions of Sections 13240 to 13244, inclusive, insofar as they are applicable, for waters for which water quality standards are required by the Federal Water Pollution Control Act and acts amendatory thereof or supplementary thereto. Such plans, when adopted, supersede any regional water quality control plans for the same waters to the extent of any conflict. (Added by Stats. 1971, Ch. 1288).

13171. The state board may establish a Water Quality Coordinating Committee, consisting of at least one member of each of the nine regional boards, to assist the state board in carrying out its responsibilities in water quality control.

(Added by Stats. 1972, Ch. 813.)

CHAPTER 4. REGIONAL WATER QUALITY CONTROL

Article 1. Organization and Membership of Regional Boards

13200. The state is divided, for the purpose of this division, into nine regions:

(a) North Coast region, which comprises all basins including Lower Klamath Lake and Lost River Basins draining into the Pacific Ocean from the California-Oregon state line southerly to the southerly boundary of the watershed of Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties.

(b) San Francisco Bay region, which comprises San Francisco Bay, Suisun Bay, from Sacramento River and San Joaquin River westerly from a line which passes between Collinsville and Montezuma Island and follows thence the boundary common to Sacramento and Solano Counties and that common to Sacramento and Contra Costa Counties to the westerly boundary of the watershed of Markley Canyon in Contra Costa County, all basins draining into the bays and rivers westerly from this line, and all basins draining into the Pacific Ocean between the southerly boundary of the north coastal region and the southerly boundary of the watershed of Pescadero Creek in San Mateo and Santa Cruz Counties.

(c) Central Coast region, which comprises all basins, including Carrizo Plain in San Luis Obispo and Kern Counties, draining into the Pacific Ocean from the southerly boundary of the watershed of Pescadero Creek in San Mateo and Santa Cruz Counties to the southeasterly boundary, located in the westerly part of Ventura County, of the watershed of Rincon Creek.

(d) Los Angeles region, which comprises all basins draining into the Pacific Ocean between the southeasterly boundary, located in the westerly part of Ventura County, of the watershed of Rincon Creek and a line which coincides with the southeasterly boundary of Los Angeles County from the ocean to San Antonio Peak and follows thence the divide between San Gabriel River and Lytle Creek drainages to the divide between Sheep Creek and San Gabriel River drainages.

(e) Santa Ana region, which comprises all basins draining into the Pacific Ocean between the southeasterly boundary of the Los Angeles region and a line which follows the drainage divide between Muddy and Moro Canyons from the ocean to the summit of San Joaquin Hills; thence along the divide between lands draining into Newport Bay and into Laguna Canyon to Niguel Road; thence along Niguel Road and Los Aliso Avenue to the divide between Newport Bay and Aliso Creek drainages; thence along that divide and the southeasterly boundary of the Santa Ana River drainage to the divide between Baldwin Lake and Mojave Desert drainages; thence along that divide to the divide between Pacific Ocean and Mojave Desert drainages.

(f) San Diego region, which comprises all basins draining into the Pacific Ocean between the southern boundary of the Santa Ana region and the California-Mexico boundary.

(g) Central Valley region, which comprises all basins including Goose Lake Basin draining into the Sacramento and San Joaquin Rivers to the easterly boundary of the San Francisco Bay region near Collinsville. The Central Valley region shall have section offices in the Sacramento Valley and the San Joaquin Valley.

(h) Lahontan region, which comprises all basins east of the Santa Ana, Los Angeles and Central Valley regions from the California-Oregon boundary to the southerly boundary located in Los Angeles and San Bernardino Counties of the watersheds draining into Antelope Valley, Mojave River Basin and Dry Lake Basin near Ivanpah.

(i) Colorado River Basin region, which comprises all basins east of the Santa Ana and San Diego regions draining into the Colorado River, Salton Sea and local sinks from the southerly boundary of the Lahontan region to the California-Mexico boundary.

The regions defined and described in this section shall be as precisely delineated on official maps of the department and include all of the areas within the boundaries of the state.

For purposes of this section the boundaries of the state extend three nautical miles into the Pacific Ocean from the line of mean lower low water marking the seaward limits of inland waters and three nautical miles from the line of mean lower low water on the mainland and each offshore island.

Nothing in this section shall limit the power conferred by this chapter to regulate the disposal of waste into ocean waters beyond the boundaries of the state.

13201. (a) There is a regional board for each of the regions described in Section 13200. Each board shall consist of the following nine members appointed by the Governor, each of whom shall represent and act on behalf of all the people and shall reside or have a principal place of business within the region:

(1) One person associated with water supply, conservation, and production.

(2) One person associated with irrigated agriculture.

(3) One person associated with industrial water use.

(4) One person associated with municipal government.

(5) One person associated with county government.

(6) One person from a responsible nongovernmental organization associated with recreation, fish, or wildlife.

(7) Three persons not specifically associated with any of the foregoing categories, two of whom shall have special competence in areas related to water quality problems.

(b) Insofar as practicable, appointments shall be made in such manner as to result in representation on the board from all parts of the region.

13202. Each member of a regional board shall be appointed for a term of four years. Vacancies shall be immediately filled by the Governor for the unexpired portion of the terms in which they occur.

13203. The official designation of each regional board shall be: California Regional Water Quality Control Board, (region name).

13204. Each regional board shall hold at least six regular meetings each calendar year and such additional special meetings or hearings as shall be called by the chairman or any two members of the regional board.

(Amended by Stats. 1970, Ch. 918.)

13205. Each member of the regional boards shall be entitled to receive his actual necessary expenses for each day while on official business of the board.

13206. Public officers, whether elected or appointed, may be appointed to, and may serve contemporaneously as members of, a regional board.

13207. (a) No member of a regional board shall participate in any board action pursuant to Article 4 (commencing with Section 13260) of Chapter 4, or Article 1 (commencing with Section 13300) of Chapter 5, of this division which involves himself or any waste discharger with which he is connected as a director, officer or employee, or in which he has a direct personal financial interest within the meaning of Section 1120 of the Government Code.

(b) No board member shall participate in any proceeding before any regional board or the state board as a consultant or in any other capacity on behalf of any waste discharger.

(c) Upon request of any person or on his own initiative the Attorney General may file a complaint in the superior court for the county in which the regional board has its principal office alleging that a board member has knowingly violated this section and the facts upon which the allegation is based and asking that the member be removed from office. Further proceedings shall be in accordance as near as may be with rules governing civil actions. If after trial the court finds that the board member has knowingly violated this section it shall pronounce judgment that the member be removed from office.

Article 2. General Provisions Relating to Powers and Duties of Regional Boards

13220. Each regional board shall:

(a) Establish an office.

(b) Select one of its members as chairman at the first regular meeting held each year.

(c) Appoint as its confidential employee, exempt from civil service, under paragraph (5) of subdivision (a) of Section 4 of Article XXIV of the Constitution, and fix the salary of, an executive officer who shall meet technical qualifications as defined by the State Water Resources Control Board. The executive officer shall serve at the pleasure of the regional board.

(d) Employ such other assistants as may be determined necessary to assist the executive officer.

13221. Members of the regional board shall be empowered to administer oaths and issue subpoenas for the attendance and giving of testimony by witnesses and for the production of evidence in any proceeding before the board in any part of the region. The provisions of Chapter 3 (commencing with Section 1075) of Part I of Division 2 of this code shall apply to regional boards within their own regions, where they shall have the same power as the state board within the state.

13222. Pursuant to such guidelines as the state board may establish, each regional board shall adopt regulations to carry out its powers and duties under this division.

13223. (a) Each regional board may delegate any of its powers and duties vested in it by this division to its executive officer excepting only the following: (1) the promulgation of any regulation; (2) the issuance, modification, or revocation of any water quality control plan, water quality objectives, or waste discharge requirement; (3) the issuance, modification, or revocation of any cease and desist order; (4) the holding of any hearing on water quality control plans; and (5) the application to the Attorney General for judicial enforcement but excluding cases of specific delegation in a cease and desist order and excluding the cases described in subdivision (c) of Section 13002 and Sections 13304 and 13340.

(b) Whenever any reference is made in this division to any action that may be taken by a regional board, such reference includes such action by its executive officer pursuant to powers and duties delegated to him by the regional board.

(Amended by Stats. 1970, Ch. 918.)

13224. Each regional board may issue policy statements relating to any water quality matter within its jurisdiction.

13225. Each regional board, with respect to its region, shall:

(a) Obtain coordinated action in water quality control, including the prevention and abatement of water pollution and nuisance.

(b) Encourage and assist in self-policing waste disposal programs, and upon application of any person, advise the applicant of the condition to be maintained in any disposal area or receiving waters into which the waste is being discharged.

(c) Require as necessary any state or local agency to investigate and report on any technical factors involved in water quality control or to obtain and submit analyses of water; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom.

(d) Request enforcement by appropriate federal, state and local agencies of their respective water quality control laws.

(e) Recommend to the state board projects which the regional board considers eligible for any financial assistance which may be available through the state board.

(f) Report to the state board and appropriate local health officer any case of suspected contamination in its region.

(g) File with the state board, at its request, copies of the record of any official action.

(h) Take into consideration the effect of its actions pursuant to this chapter on the California Water Plan adopted or revised pursuant to Division 6 (commencing with Section 10000) of this code and on any other general or coordinated governmental plan looking toward the development, utilization or conservation of the water resources of the state.

(i) Encourage regional planning and action for water quality control.

Article 3. Regional Water Quality Control Plans

13240. Each regional board shall formulate and adopt water quality control plans for all areas within the region. Such plans shall conform to the policies set forth in Chapter 1 (commencing with Section 13000) of this division and any state policy for water quality control. During the process of formulating such plans the regional boards shall consult with and consider the recommendations of affected state and local agencies. Such plans shall be periodically reviewed and may be revised.

13241. Each regional board shall establish such water quality objectives in water quality control plans as in its judgment will ensure the reasonable protection of beneficial uses and the prevention of nuisance; however, it is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in establishing water quality objectives shall include, but not necessarily be limited to, all of the following:

(a) Past, present, and probable future beneficial uses of water.

(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

(d) Economic considerations.

13242. The program of implementation for achieving water quality objectives shall include, but not be limited to:

(a) A description of the nature of actions which are necessary to achieve the objectives, including recommendations for appropriate action by any entity, public or private.

(b) A time schedule for the actions to be taken.

(c) A description of surveillance to be undertaken to determine compliance with objectives.

13243. A regional board, in a water quality control plan or in waste discharge requirements, may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.

13244. The regional boards shall not adopt any water quality control plan unless a public hearing is first held, after the giving of notice of such hearing by publication in the affected county or counties pursuant to Section 6061 of the Government Code. When the plan proposes to prohibit discharges of waste pursuant to Section 13243, similar notice shall be given by publication pursuant to Section 6061.3 of the Government Code.

13245. A water quality control plan, or a revision thereof adopted by a regional board, shall not become effective unless and until it is approved by the state board. The state board may approve such plan, or return it to the regional board for further consideration and resubmission to the state board. Upon resubmission the state board may either approve or, after a public hearing in the affected region, revise and approve such plan.

(Amended by Stats. 1971, Ch. 1288.)

13246. The state board shall act upon any water quality control plan within 60 days after the regional board has submitted such plan to the state board, or 90 days after resubmission of such plan.

13247. State offices, departments, and boards, in carrying out activities which may affect water quality, shall comply with water quality control plans approved or adopted by the state board unless otherwise directed or authorized by statute, in which case they shall indicate to the regional boards in writing their authority for not complying with such plans.

(Amended by Stats. 1971, Ch. 1288.)

Article 4. Waste Discharge Requirements

13260. (a) Any person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the state, other than into a community sewer system, and any person who is a citizen, domiciliary, or political agency or entity of this state discharging waste or proposing to discharge waste outside the boundaries of the state in a manner that could affect the quality of the waters of the state within any region, shall file with the regional board of that region a report of the discharge, containing such information as may be required by the board. No report need be filed when such requirement is waived pursuant to Section 13269.

(b) Every such person discharging waste shall file with the regional board of that region a report of any material change or proposed change in the character, location, or volume of the discharge.

(c) Each report under this section shall be sworn to or submitted under penalty of perjury.

(d) Each report under this section shall be accompanied by a filing fee of not to exceed one thousand dollars ($1,000) according to a reasonable fee schedule established by the state board.

(e) When a report filed by any person pursuant to this section is not adequate in the judgment of the regional board, the board may require such person to supply such additional information as it deems necessary.

13261. Any person failing to furnish a report under Section 13260 when so requested by a regional board is guilty of a misdemeanor.

(Amended by Stats. 1970, Ch. 918.)

13262. The Attorney General, at the request of the regional board, shall petition the superior court for the issuance of a temporary restraining order, temporary injunction, or permanent injunction, or combination thereof, as may be appropriate, requiring any person not complying with Section 13260 to comply therewith.

13263. (a) The regional board, after any necessary hearing, shall prescribe requirements as to the nature of any proposed discharge, existing discharge, or material change therein, except discharges into a community sewer system, with relation to the conditions existing from time to time in the disposal area or receiving waters upon or into which the discharge is made or proposed. The requirements shall implement relevant water quality control plans, if any have been adopted, and shall take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of Section 13241.

(b) A regional board, in prescribing requirements, need not authorize the utilization of the full waste assimilation capacities of the receiving waters.

(c) The requirements may contain a time schedule, subject to revision in the discretion of the board.

(d) The board may prescribe requirements although no discharge report has been filed.

(e) Upon application by any affected person or on its own motion, the regional board may review and revise requirements. All requirements shall be reviewed periodically.

(f) The regional board shall notify in writing the person making or proposing the discharge or the change therein of the discharge requirements to be met. After receipt of such notice, the person so notified shall provide adequate means to meet such requirements.

(g) No discharge of waste into the waters of the state, whether or not such discharge is made pursuant to waste discharge requirements, shall create a vested right to continue such discharge. All discharges of waste into waters of the state are privileges, not rights.

13264. (a) No person shall initiate any new discharge of waste or make any material change in any discharge prior to the filing of the report required by Section 13260 nor shall any such person do so thereafter and prior to: (1) the issuance of waste discharge requirements pursuant to Section 13263, (2) the expiration of 120 days after his compliance with Section 13260, or (3) the regional board's waiver pursuant to Section 13269, whichever of (1), (2), or (3) occurs first.

(b) The Attorney General, at the request of a regional board, shall petition the superior court for the issuance of a temporary restraining order, preliminary injunction, or permanent injunction, or combination thereof, as may be appropriate, prohibiting forthwith any person who is violating or threatening to violate this section from: (1) discharging the waste in question or (2) making any material change therein, whichever of (1) or (2) is applicable.

(Amended by Stats. 1970, Ch. 918.)

13265. Any person discharging waste in violation of Section 13264, after such violation has been called to his attention in writing by the regional board, is guilty of a misdemeanor. Each day of such discharge shall constitute a separate offense.

13266. Pursuant to such regulations as the regional board may prescribe, each city, county, or city and county shall notify the regional board of the filing of a tentative subdivision map, or of any application for a building permit which may involve the discharge of waste, other than discharges into a community sewer system and discharges from dwellings involving five-family units or less.

13267. (a) A regional board, in establishing or reviewing any water quality control plan or waste discharge requirements, or in connection with any action relating thereto or authorized by this division, may investigate the quality of any waters of the state within its region.

(b) In such an investigation, the regional board may require that any person discharging or proposing to discharge waste within its region or any citizen or domiciliary, or political agency or entity of this state discharging or proposing to discharge waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, such technical or monitoring program reports as the board may specify; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom.

When requested by the person furnishing a report, the portions of a report which might disclose trade secrets or secret processes shall not be made available for inspection by the public but shall be made available to governmental agencies for use in making studies; provided, however, that such portions of a report shall be available for use by the state or any state agency in judicial review or enforcement proceedings involving the person furnishing the report.

(c) In such an investigation, the regional board may inspect the facilities of any such person to ascertain whether the purposes of this division are being met and waste discharge requirements are being complied with. Such inspection shall be made with the consent of the owner or possessor of such facilities or, if such consent is refused, with a warrant duly issued pursuant to the procedure set forth in Title 13 (commencing with Section 1822.50) of Part 3 of Code of Civil Procedure; provided, however, that in the event of an emergency affecting the public health or safety such inspection may be made without consent or the issuance of a warrant.

(Amended by Stats. 1970, Ch. 918.)

13268. **Any person failing or refusing to furnish technical or monitoring program reports as required by subdivision (b) of Section 13267 or falsifying any information provided therein is guilty of a misdemeanor.**

13269. **The provisions of subdivisions (a) and (b) of Section 13260, subdivision (a) of Section 13263, or subdivision (a) of Section 13264 may be waived by a regional board as to a specific discharge or a specific type of discharge where such waiver is not against the public interest. Such waiver shall be conditional and may be terminated at any time by the board.**

CHAPTER 5. ENFORCEMENT AND IMPLEMENTATION

Article 1. Administrative Enforcement and Remedies by Regional Boards

13300. Whenever a regional board finds that a discharge of waste is taking place or threatening to take place that violates or will violate requirements prescribed by the regional board or the state board, or that the waste collection, treatment, or disposal facilities of a discharger are approaching capacity, the board may require the discharger to submit for approval of the board, with such modifications as it may deem necessary, a detailed time schedule of specific actions the discharger shall take in order to correct or prevent a violation of requirements.

(Amended by Stats. 1971, Ch. 1288.)

13301. When a regional board finds that a discharge of waste is taking place or threatening to take place in violation of requirements or discharge prohibitions prescribed by the regional board or the state board, the board may issue an order to cease and desist and direct that those persons not complying with the requirements or discharge prohibitions (a) comply forthwith, (b) comply in accordance with a time schedule set by the board, or (c) in the event of a threatened violation, take appropriate remedial or preventive action. In the event of an existing or threatened violation of waste discharge requirements in the operation of a community sewer system, cease and desist orders may restrict or prohibit the volume, type, or concentration of waste that might be added to such system by dischargers who did not discharge into the system prior to the issuance of the cease and desist order. Cease and desist orders may be issued directly by a board, after notice and hearing, or in accordance with the procedure set forth in Section 13302.

(Amended by Stats. 1971, Ch. 1288.)

13301.1. The regional board shall render to persons against whom a cease and desist order is issued pursuant to Section 13301 all possible assistance in making available current information on successful and economical water quality control programs, as such information is developed by the state board pursuant to Section 13167, and information and assistance in applying for federal and state funds necessary to comply with the cease and desist order.

(Added by Stats. 1970, Ch. 1464.)

13302. **(a) Hearings for consideration of issuance of a cease and desist order may be conducted by hearing panels designated by the regional board, each panel to consist of three or more members of the board as it may specify. A member of the board may serve on more than one panel.**

(b) Due notice of the hearing shall be given to all affected persons. After the hearing, the panel shall report its proposed decision and order to the regional board and shall supply a copy to all parties who appeared at the hearing and requested a copy. Members of the panel are not disqualified from sitting as members of the board in deciding the matter. The board, after making such independent review of the record and taking such additional evidence as may be necessary, may adopt, with or without revision, the proposed decision and order of the panel.

13303. **Cease and desist orders of the board shall become effective** and final upon issuance thereof. Copies shall be served forthwith by personal service or by registered mail upon the person being charged with the violation of the requirements and upon other affected persons who appeared at the hearing and requested a copy.

(Amended by Stats. 1972, Ch. 813.)

13304. (a) Any person who discharges waste into the waters of this state in violation of any waste discharge requirement or other order issued by a regional board or the state board, or who intentionally or negligently causes or permits any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board clean up such waste or abate the effects thereof or, in the case of threatened pollution or nuisance, take other necessary remedial action. Upon failure of any person to comply with such cleanup or abatement order, the Attorney General, at the request of the board, shall petition the superior court for that county for the issuance of an injunction requiring such person to comply therewith. In any such suit, the court shall have jurisdiction to grant a prohibitory or mandatory injunction, either preliminary or permanent, as the facts may warrant.

(b) The regional board may expend available moneys to perform any cleanup, abatement, or remedial work required under the circumstances set forth in subdivision (a) which in its judgment is required by the magnitude of endeavor or urgency of prompt action needed to prevent substantial pollution, nuisance, or injury to any waters of the state. Such action may be taken in default of, or in addition to, remedial work by the waste discharger or other persons, and regardless of whether injunctive relief is being sought. The regional board may perform the work itself, or by or in cooperation with any other governmental agency, and may use rented tools or equipment, either with operators furnished or unoperated. Notwithstanding any other provisions of law, the regional board may enter into oral contracts for such work, and the contracts, whether written or oral, may include provisions for equipment rental and in addition the furnishing of labor and materials necessary to accomplish the work. Such contracts shall be exempt from approval by the Department of General Services pursuant to the provisions of Section 14780 of the Government Code.

(c) If such waste is cleaned up, the effects thereof abated, or, in the case of threatened pollution or nuisance, other necessary remedial action is taken by any governmental agency, the person or persons who discharged the waste, within the meaning of subdivision (a), shall be liable to that governmental agency to the extent of the reasonable costs actually incurred in cleaning up such waste, abating the effects thereof, or taking other remedial action. The amount of such costs shall be recoverable in a civil action by, and paid to, such governmental agency and the state board to the extent of the latter's contribution to the cleanup costs from the State Water Pollution Cleanup and Abatement Account or other available funds.

(Amended by Stats. 1971, Ch. 1288).

(Note the new authority of regional boards in subsection (b) to expend available moneys to perform cleanup work when a cleanup order has been issued under subsection (a), and prompt action is needed to prevent substantial pollution or nuisance. Full authority to take all necessary actions can be delegated to the executive officer (Section 13223). "Available moneys" ordinarily refers to moneys in the State Water Pollution and Abatement Account (Section 13441). Funds made available from an outside source, such as the Federal Government, could also constitute "available moneys". Note that authority to expend moneys for cleanup requires an exercise of judgment. For accounting purposes it is desirable that the exercise of judgment be in writing. A letter to the state board should request needed funds and give the reason in the context of the statute, such as the existence of an "urgency of prompt action is needed to prevent substantial pollution". A previous phone call could ascertain whether necessary funds are available.)

13305. (a) Upon determining that a condition of pollution or nuisance exists which has resulted from a nonoperating industrial or business location within its region, a regional board may cause notice of such condition to be posted upon the property in question. The notice shall state that such condition constitutes either a condition of pollution or nuisance which must be abated by correction of such condition, otherwise it will be corrected by the city, county, other public agency, or regional board at the property owner's expense. Such notice shall further state that all property owners having any objections to the proposed correction of such condition may attend a hearing to be held by the board at a time not less than 10 days from the posting of the notice.

(b) Notice of the hearing prescribed in this section shall be given in the county where the property is located pursuant to Section 6061 of the Government Code.

(c) In addition to posting and publication, notice as required in this section shall be mailed to the property owners as their names and addresses appear from the last equalized assessment role.

(d) At the time stated in the notices, the board shall hear and consider all objections or protests, if any, to the proposed correction of the condition, and may continue the hearing from time to time.

(e) After final action is taken by the board on the disposition of any protests or objections, or in case no protests or objections are received, the board shall request the city, county, or other public agency in which the conditions of pollution or the nuisance exists to abate it. In the event that such city, county, or other public agency does not abate such condition within a reasonable time the board shall cause the condition to be abated. It may proceed by force account, contract or other agreement or any other method deemed most expedient by the board, and shall apply to the state board for the necessary funds.

(f) The owner of the property on which the condition exists, or is created, is liable for all reasonable costs incurred by the board or any city, county, or public agency in abating the condition. The amount of the cost for abating the condition upon the property in question shall constitute a lien upon the property so posted upon the recordation of a notice of lien, particularly describing the property on which the condition was abated and the amount of such lien, in the office of the county recorder of the county in which the property is located. Upon such recordation, the lien shall have the same force, effect, and priority as if it had been a judgment lien imposed upon real property which was not exempt from execution, except that it shall attach only to the property so posted and described in such notice of lien. Such lien may be foreclosed by an action brought by the city, county, other public agency, or state board, on behalf of the regional board, for a money judgment. Money recovered by a judgment in favor of the state board shall be returned to the State Water Pollution Cleanup and Abatement Account.

(g) The city, county, other public agency, or state board on behalf of a regional board, may at any time release all or any portion of the property subject to a lien imposed pursuant to subdivision (f) from the lien or subordinate such lien to other liens and encumbrances if it determines that the amount owed is sufficiently secured by a lien on other property or that the release or subordination of such lien will not jeopardize the collection of such amount owed. A certificate by such board, city, county, or other public agency to the effect that any property has been released from such lien or that such lien has been subordinated to other liens and encumbrances shall be conclusive evidence that the property has been released or that the lien has been subordinated as provided in such certificate.

(h) As used in this section, the words "nonoperating" or "not in operation" means the business is not conducting routine operations usually associated with that kind of business.

(Amended by Stats. 1970, Ch. 1462.)

Article 2. Administrative Enforcement and Remedies by the State Board

13320. (a) Within 30 days of any action or failure to act by a regional board under subdivision (c) of Section 13225, Article 4 (commencing with Section 13260) of Chapter 4 of this division, Chapter 5 (commencing with Section 13300) of this division, Chapter 7 (commencing with Section 13500) of this division, or Division 7.5 (commencing with Section 14000), any aggrieved person may petition the state board to review such action or failure to act. In case of failure to act, the 30-day period shall commence upon refusal of the board to act, or 60 days after request has been made to the board to act. The state board may, on its own motion, at any time review such action or failure to act and also any failure to act under Article 3 (commencing with Section 13240) of Chapter 4 of this division.

(b) The evidence before the state board shall consist of (i) the record before the regional board, and (ii) any other relevant evidence which, in the judgment of the state board, should be considered to effectuate and implement the policies of this division.

(c) The state board may find the regional board action or inaction to be appropriate and proper. Upon finding that the action of the regional board, or the failure of the regional board to act, was inappropriate or improper, the state board may: (1) direct that the appropriate action be taken by the regional board, (2) refer the matter to any other state agency having jurisdiction, (3) take the appropriate action itself, or (4) any combination of the foregoing. In taking any such action, the state board is vested with all the powers of the regional boards under this division.

(d) In the event a waste discharge in one region affects the waters in another region and there is any disagreement between the regional boards involved as to the requirements which should be established, either regional board may submit the disagreement to the state board which shall determine the applicable requirements.

(Amended by Stats. 1971, Ch. 1288).

13321. (a) In the case of a review by the state board under Section 13320, the state board, upon notice and a hearing, may stay in whole or in part the effect of the decision and order of a regional board or of the state board.

(b) If a petition is filed with the superior court to review a decision of the state board, any stay in effect at the time of the filing the petition shall remain in effect by operation of law for a period of 20 days from the date of the filing of such petition.

Article 3. Judicial Review and Enforcement

13330. (a) Within 30 days after service of a copy of a decision and order issued by the state board under Section 13320, any aggrieved party may file with the superior court a petition for a writ of mandate for review thereof. Failure to file such an action shall not preclude a party from challenging the reasonableness and validity of a decision or order of a regional board or the state board in any judicial proceedings brought to enforce such decision or order or for other civil remedies.

(b) The evidence before the court shall consist of the record before the state board, including the regional board's record, and any other relevant evidence which, in the judgment of the court, should be considered to effectuate and implement the policies of this division. In every such case, the court shall exercise its independent judgment on the evidence.

(c) Except as otherwise provided herein, the provisions of subdivisions (e) and (f) of Section 1094.5 of the Code of Civil Procedure shall govern proceedings pursuant to this section.

13331. (a) Upon the failure of any person or persons to comply with any cease and desist order issued by a regional board or the state board, the Attorney General, upon request of the board, shall petition the superior court for the issuance of a preliminary or permanent injunction, or both, as may be appropriate, restraining such person or persons from continuing the discharge in violation of the cease and desist order.

(b) The evidence before the court shall consist of the record before the regional board or state board, or both, and any other relevant evidence which, in the judgment of the court, should be considered to effectuate and implement the policies of this division. In every such case, the court shall exercise its independent judgment on the evidence.

(c) The court shall issue an order directing defendants to appear before the court at a time and place certain and show cause why the injunction should not be issued. The court may grant such prohibitory or mandatory relief as may be warranted.

(d) The court may stay the operation of the cease and desist order after notice to the board which issued the order and hearing. Any such stay may be imposed or continued only if it is not against the public interest.

(Amended by Stats. 1970, Ch. 918.)

Article 4. Summary Judicial Abatement

13340. Whenever a regional board finds that a discharge of waste within its region is taking place or threatening to take place which does or will cause a condition of pollution or nuisance, constituting an emergency requiring immediate action to protect the public health, welfare, or safety, the Attorney General, upon request of the board, shall petition the superior court to enjoin such discharge. The court shall have jurisdiction to grant such prohibitory or mandatory injunctive relief as may be warranted by way of temporary restraining order, preliminary injunction, and permanent injunction.

Article 5. Civil Monetary Remedies

13350. (a) Any person who (1) intentionally or negligently violates any cease and desist order hereafter issued, reissued, or amended by a regional board or the state board, or (2) in violation of any waste discharge requirement or other order issued, reissued, or amended by a regional board or the state board, intentionally or negligently discharges waste or causes or permits waste to be deposited where it is discharged into the waters of the state and creates a condition of pollution or nuisance, or (3) causes or permits any oil or any residuary product of petroleum to be deposited in or on any of the waters of the state, except in accordance with waste discharge requirements or other provisions of this division, may be liable civilly in a sum of not to exceed six thousand dollars ($6,000) for each day in which such violation or deposit occurs.

(b) The Attorney General, upon request of a regional board or the state board, shall petition the superior court to impose, assess and recover such sums. Except in the case of a violation of a cease and desist order, a regional board or the state board shall make such request only after a hearing, with due notice of the hearing given to all affected persons. In determining such amount, the court shall take into consideration all relevant circumstances, including but not limited to, the extent of harm caused by the violation, the nature and persistence of the violation, the length of time over which the violation occurs and corrective action, if any, taken by the discharger.

(c) The provisions of Articles 3 (commencing with Section 13330) and 6 (commencing with Section 13360) of this chapter shall apply to proceedings to impose, assess and recover an amount pursuant to this article.

(d) Remedies under this section are in addition to, and do not supersede or limit, any and all other remedies, civil or criminal.

(Amended by Stats. 1971, Ch. 668.)

Article 6. General Provisions Relating to Enforcement and Review

13360. No waste discharge requirement or other order of a regional or state board or decree of court issued under the provisions of this division shall specify the design, location, type of construction or particular manner in which compliance may be had with such requirement, order or decree, and the person so ordered shall be permitted to comply therewith in any lawful manner; provided, as to disposal sites other than those found by the state board to be adequately regulated by another governmental agency under subdivision (b) of Section 14020 and evaporation ponds from which there is no drainage or seepage, the restrictions of this section shall not apply to waste discharge requirements or orders or decrees with respect to the discharge of solid waste requiring the installation of riprap, the construction of walls and dikes, the installation of surface and underground drainage facilities to prevent runoff from entering the disposal area or leakage to underground or surface waters or other reasonable requirements to achieve the above or similar purposes, and provided further that if the court, in an action for an injunction brought under this division, finds that the enforcement of an injunction restraining the discharger from discharging waste would be impracticable, the court shall have the power to issue any order reasonable under the circumstances requiring specific measures to be undertaken by the discharger to comply with the discharge requirements, order or decree.

(Amended by Stats. 1971, Ch. 1288.)

13361. (a) Every civil action brought under the provisions of this division at the request of a regional board or the state board shall be brought by the Attorney General in the name of the people of the State of California and any such actions relating to the same discharge may be joined or consolidated.

(b) Any civil action brought pursuant to this division shall be brought in a county in which the discharge is made, or proposed to be made. However, any action by or against a city, city and county, county, or other public agency shall, upon motion of either party, be transferred to a county or city and county not a party to the action or to a county or city and county other than that in which the city or public agency is located.

(c) In any civil action brought pursuant to this division in which a temporary restraining order, preliminary injunction, or permanent injunction is sought, it shall not be necessary to allege or prove at any stage of the proceeding that irreparable damage will occur should the temporary restraining order, preliminary injunction, or permanent injunction not be issued, or that the remedy at law is inadequate, and the temporary restraining order, preliminary injunction, or permanent injunction shall issue without such allegations and without such proof.

(Amended by Stats. 1970, Ch. 918.)

Chapter 5.5. Compliance With the Provisions of the Federal Water Pollution Control Act as Amended in 1972

(Added by Stats. 1972, Ch. 1256)

13370. The Legislature finds and declares that since the Federal Water Pollution Control Act (33 U.S.C. 1151, et seq.), as amended, provides for a permit system to regulate the discharge of pollutants to the navigable waters of the United States and provides that permits may be issued by states which are authorized to implement the provisions of such act, it is in the interest of the people of the state, in order to avoid direct regulation by the federal government of persons already subject to regulation under state law pursuant to this division, to enact the provisions of this chapter in order to authorize the state to implement the provisions of the Federal Water Pollution Control Act and acts amendatory thereof or supplementary thereto, and federal regulations and guidelines issued pursuant thereto.

13371. The Legislature further finds and declares that it is necessary for the state board to amend its administrative regulations in order to comply with the Federal Water Pollution Control Act and regulations and guidelines adopted thereunder.

13372. To the extent other provisions of this division are consistent with the provisions of this chapter, such provisions shall be applicable to actions and procedures provided for in this chapter. The provisions of this chapter shall prevail over other provisions of this division to the extent of any inconsistency. The provisions of this chapter shall apply only to actions required under the Federal Water Pollution Control Act, as amended.

13373. The terms "navigable waters," "effluent limitations," "administrator," "pollutants," "biologic monitoring," "discharge" and "point sources" as used in this chapter shall have the same meaning as in the Federal Water Pollution Control Act and acts amendatory thereof or supplementary thereto.

13374. The term "waste discharge requirements" as referred to in this division is the equivalent of the term "permits" as used in the Federal Water Pollution Control Act, as amended.

13375. The discharge of any radiological, chemical, or biological warfare agent into the waters of the state is hereby prohibited.

13376. Any person discharging pollutants or proposing to discharge pollutants to the navigable waters of the United States within the jurisdiction of this state shall file a report of such discharge in compliance with the procedures set forth in Section 13260. Any person proposing to discharge pollutants shall file a report at least 180 days in advance of the date on which it is desired to commence the discharge of pollutants. Any person presently discharging pollutants shall file a report within 45 days of a written request by a regional board or the state board. The discharge of pollutants by any person except as authorized pursuant to waste discharge requirements is prohibited.

13377. Notwithstanding any other provision of this division, the state board or the regional boards shall as required or authorized by the Federal Water Pollution Control Act, as amended, issue waste discharge requirements which ensure compliance with any applicable effluent limitations, water quality related effluent limitations, national standards of performance, toxic and pretreatment effluent standards, and any ocean discharge criteria.

13378. Waste discharge requirements shall be adopted only after notice and any necessary hearing. Such requirements shall be adopted for a fixed term not to exceed five years for any proposed discharge, existing discharge, or any material change therein.

13379. Waste discharge requirements shall be adopted to meet the following:

(a) Not later than July 1, 1977, effluent limitations for point sources, other than publicly owned treatment works, which (1) shall require the application of the best practicable control technology currently available as defined under the Federal Water Pollution Control Act, as amended, or (2) in the case of a discharge into a publicly owned treatment works as defined in subdivision (b), shall require compliance with any applicable pretreatment or toxicity requirements.

(b) For publicly owned treatment works in existence on July 1, 1977, or approved pursuant to the Federal Water Pollution Control Act, as amended, prior to June 30, 1974, for which construction shall be completed within four years of approval, effluent limitations based upon secondary treatment, as defined under the Federal Water Pollution Control Act.

(c) Not later than July 1, 1977, any more stringent limitation, including those necessary to meet water quality standards, treatment standards, or schedules of compliance under this division or as required under the Federal Water Pollution Control Act, as amended.

(d) Not later than July 1, 1983, effluent limitations for categories and classes of point sources, other than publicly owned treatment works, which (1) shall require application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the goal of eliminating the discharge of all pollutants as determined under the Federal Water Pollution Control Act, as amended, or (2) in the case of the introduction of a pollutant into a publicly owned treatment works which meets the requirements referred to in subdivision (e), shall require compliance with any applicable pretreatment or toxicity requirements.

(e) Not later than July 1, 1983, compliance by all publicly owned treatment works, with requirements promulgated under the Federal Water Pollution Control Act, as amended.

(f) Any more stringent effluent standards or limitations necessary to implement water quality control plans, or for the protection of beneficial uses or to prevent nuisance.

(g) National standards of performance promulgated by the administrator.

(h) Pretreatment requirements as determined by the administrator.

(i) Ocean discharge criteria promulgated by the administrator.

13380. Any waste discharge requirement adopted under this chapter shall be reviewed at least every five years and, if appropriate, revised.

13381. Waste discharge requirements may be terminated or modified for cause, including, but not limited to, all of the following:

(a) Violation of any condition contained in the requirements.

(b) Obtaining the requirements by misrepresentation, or failure to disclose fully all relevant facts.

(c) A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

13382. Waste discharge requirements shall be adopted to control the disposal of pollutants into wells.

13383. The state board or regional boards may require dischargers of pollutants to navigable waters or to public treatment systems to establish and maintain records, make reports, install, use and maintain monitoring equipment or methods, including, where appropriate, biological monitoring methods, sample effluent as prescribed, and provide other information as may be reasonably required. The state board or regional boards may inspect the facilities of any discharger of pollutants pursuant to the procedure set forth in subdivision (c) of Section 13267.

13384. The state board or the regional boards shall ensure that the public, and that any other state, the waters of which may be affected by any discharge of pollutants to navigable waters within this state, shall receive notice of each application for requirements or report of waste discharge and are provided an opportunity for public hearing before adoption of such requirements.

13385. Any person who discharges pollutants, except as permitted by waste discharge requirements, or who violates any cease and desist order, prohibition, waste discharge requirement, effluent limitation, water quality related effluent limitation, national standard of performance, pretreatment or toxicity standard or who refuses to comply with the requirements adopted pursuant to Section 13382 shall be subject to a civil penalty not to exceed ten thousand dollars ($10,000) for each day in which such discharge, violation, or refusal occurs. Funds collected shall be paid to the State Water Pollution Cleanup and Abatement Account.

13386. (a) The Attorney General, upon request of a regional board or the state board, shall petition the superior court to impose, assess and recover the sums provided in Section 13385.

(b) Upon the violation of the terms of any cease and desist order, prohibition, waste discharge requirement, effluent limitation, water quality related effluent limitation, national standard of performance, pretreatment or toxicity standard, the requirements of Section 13383, or upon the failure of any discharger into a public treatment system to comply with any cost or charge adopted by any public agency under Section 204(b) of the Federal Water Pollution Control Act, as amended, the Attorney General, upon the request of the state board or regional board shall petition the appropriate court for the issuance of a preliminary or permanent injunction, or both, as may be appropriate, restraining such person or persons from continuing the violation. The provisions of subdivisions (b) and (c) of Section 13331 shall be applicable to proceedings under this subdivision.

(c) With respect to violation of waste discharge requirements or cease and desist orders, remedies under Section 13385 are in lieu of civil monetary remedies provided for in Section 13350.

13387. (a) Any person who willfully or negligently discharges pollutants except as allowed by waste discharge requirements or who willfully or negligently violates any effluent standard, water quality related effluent standard, national standard of performance, toxicity or pretreatment standard, or who refuses to comply with the requirements adopted pursuant to Section 13382, or who violates any cease and desist order, prohibition, or waste discharge requirement shall be punished by a fine of not more than twenty-five thousand dollars ($25,000) nor less than two thousand five hundred dollars ($2,500) for each day in which such violation occurs, or by imprisonment for not more than one year in the county jail, or by both. If the conviction is for a violation committed after a first conviction of such person under this section, punishment shall be by a fine of not more than fifty thousand dollars ($50,000) for each day in which such violation occurs, or by imprisonment for not more than two years in the county jail, or both. Funds collected shall be paid to the State Water Pollution Cleanup and Abatement Account.

(b) Any person who knowingly makes any false statement, representation, record, report, plan or other document filed with a regional board or the state board, or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required under this division shall be punished by a fine of not more than ten thousand dollars ($10,000), or by imprisonment in a county jail for not more than six months, or by both.

13388. Notwithstanding any other provision of this division or Section 175, no person shall be a member of the state board or a regional board if he receives or has received during the previous two years a significant portion of his income directly or indirectly from any person subject to waste discharge requirements or applicants for waste discharge requirements pursuant to this chapter. This section shall become operative on March 1, 1973.

13389. Neither the state board nor the regional boards shall be required to comply with the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code prior to the adoption of any waste discharge requirement, except requirements for new sources as defined in the Federal Water Pollution Control Act or acts amendatory thereof or supplementary thereto.

CHAPTER 6. STATE FINANCIAL ASSISTANCE

Article 1. State Water Quality Control Fund

13400. As used in this chapter, unless otherwise apparent from the context:

(a) "Fund" means the State Water Quality Control Fund.

(b) "Public agency" means any city, county, city and county, district, or other political subdivision of the state.

(c) "Facilities" means either or both: (1) facilities for the collection, treatment, or export of waste when necessary to prevent water pollution or (2) facilities to reclaim waste waters and to convey reclaimed water.

13401. The State Water Quality Control Fund is continued in existence. The following moneys in the fund are appropriated, without regard to fiscal years, for expenditure by the state board in making loans to public agencies in accordance with the provisions of this chapter:

(a) The balance of the original moneys deposited therein.

(b) Any money repaid thereto.

(c) Any remaining balance of the money in the fund deposited therein after the specific appropriations for loans to the South Tahoe Public Utility District, the North Tahoe Public Utility District, the Tahoe City Public Utility District, the Truckee Sanitary District, and to any other governmental entity in the areas served by such districts have been made.

Article 2. Loans to Local Agencies

13410. Applications for construction loans under this chapter shall include:

(a) A description of the proposed facilities.

(b) A statement of facts showing the necessity for the proposed facilities and showing that funds of the public agency are not available for financing such facilities and that the sale of revenue or general obligation bonds through private financial institutions is impossible or would impose an unreasonable burden on the public agency.

(c) A proposed plan for repaying the loan.

(d) Other information as required by the state board.

13411. Upon a determination by the state board, after consultation with the State Department of Health,[*] that (a) the facilities proposed by an applicant are necessary to the health or welfare of the inhabitants of the state, (b) that the proposed facilities meet the needs of the applicant, (c) that funds of the public agency are not available for financing such facilities and that the sale of revenue or general obligation bonds through private financial institutions is impossible or would impose an unreasonable burden on the public agency, (d) that the proposed plan for repayment is feasible, (e) in the case of facilities proposed under Section 13400(c)(1) that such facilities are necessary to prevent water pollution, and (f) in the case of facilities proposed under Section 13400(c)(2) that such facilities will produce reclaimed water and that the public agency has adopted a feasible program for use thereof, the state board, subject to approval by the Director of Finance, may loan to the applicant such sum as it determines is not otherwise available to the public agency to construct the proposed facilities.

(Amended by Stats. 1971, Ch. 1593.)

13412. No loan shall be made to a public agency unless it executes an agreement with the state board under which it agrees to repay the amount of the loan, with interest, within 25 years following, at the election of the state board and with the concurrence of the Director of Finance, a 10-year moratorium on principal and interest payments Except as otherwise provided in this section, the interest shall be at a rate equal to the average, as determined by the state board, of the net interest costs to the state on the sales of general obligation bonds of the state that occurred during the period of five calendar years immediately preceding the year in which the loan agreement is executed. However, when the applicable average of the net interest costs to the state is not a multiple of one-tenth of 1 percent, the interest rate shall be at the multiple of one-tenth of 1 percent next above the applicable average of the net interest costs.

The interest rate applicable to any loan made pursuant to this chapter for which an application was filed prior to January 1, 1967, shall be at the rate of 2 percent.

(Amended by Stats. 1970, Ch. 1159.)

13413. It is the policy of this state that, in making construction loans under this article, the state board should give special consideration to facilities proposed to be constructed by public agencies in areas in which further construction of buildings has been halted by order of the State Department of Health[*] or a local health department, or both, or notice has been given that such an order is being considered; provided, however, that the public agencies designated in this section shall otherwise comply with and meet all requirements of other provisions of this chapter.

(Amended by Stats. 1969, Ch. 800.)

13414. All money received in repayment of loans under this chapter shall be paid to the State Treasurer and credited to the fund.

13415. (a) Loans may be made by the state board to public agencies to pay not more than one-half of the cost of studies and investigations made by such public agencies in connection with waste water reclamation.

(b) Not more than a total of two hundred thousand dollars ($200,000) shall be loaned pursuant to this section in any fiscal year, and not more than fifty thousand dollars ($50,000) shall be loaned to any public agency in any fiscal year pursuant to this section. In the event that less than two million dollars ($2,000,000) is available in any fiscal year for loans under this article, then not more than 10 percent of the available amount shall be available for loans for studies and investigations pursuant to this section.

(c) Applications for such loans shall be made in such form, and shall contain such information, as may be required by the state board.

(d) Such loans shall be repaid within a period not to exceed 10 years, with interest at a rate established in the manner provided in Section 13412.

13416. Before a public agency may enter into a contract with the state board for a construction loan under this chapter, the public agency shall hold an election on the proposition of whether or not the public agency shall enter into the proposed contract and more than 50 percent of the votes cast at such election must be in favor of such proposition.

NOTE. Modified by Stats. 1972, Ch. 813, which provides in part:

The provisions of Sections 13416 and 13417 of the Water Code shall not apply to any loan to the Isla Vista Sanitary District, the Squaw Valley County Water District, or the Alpine Springs County Water District pursuant to the provisions of Chapter 6 (commencing with Section 13400) of Division 7 of the Water Code.

13417. The election shall be held in accordance with the following provisions:

(a) The procedure for holding an election on the incurring of bonded indebtedness by such public agency shall be utilized for an election of the proposed contract as nearly as the same may be applicable. Where the law applicable to such agency does not contain such bond election procedure, the procedure set forth in the Revenue Bond Law of 1941 (Chapter 6 (commencing with Section 54300) Part 1, Division 2, Title 5 of the Government Code), as it may now or hereafter be amended, shall be utilized as nearly as the same may be applicable.

(b) No particular form of ballot is required.

(c) The notice of the election shall include a statement of the time and place of the election, the purpose of the election, the general purpose of the contract, and the maximum amount of money to be borrowed from the state under the contract.

(d) The ballots for the election shall contain a brief statement of the general purpose of the contract substantially as stated in the notice of the election, shall state the maximum amount of money to be borrowed from the state under the contract, and shall contain the words "Execution of contract—Yes" and "Execution of contract—No."

(e) The election shall be held in the entire public agency except where the public agency proposes to contract with the state board on behalf of a specified portion, or of specified portions, of the public agency, in which case the election shall be held in such portion or portions of the public agency only.

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[*] Note: New name effective July 1, 1973. Formerly called Department of Public Health and State Board of Public Health.

Article 3. State Water Pollution Cleanup and Abatement Account

13440. There is in the State Water Quality Control Fund the State Water Pollution Cleanup and Abatement Account (hereinafter called the "account"), to be administered by the state board.

13441. There is to be paid into the account all moneys from the following sources:

(a) All moneys appropriated by the Legislature for the account.

(b) All moneys contributed to the account by any person and accepted by the state board.

(c) One-half of all moneys collected by way of criminal penalty and all moneys collected civilly under any proceeding brought pursuant to any provision of this division.

(d) All moneys collected by the state board for the account under Section 13304.

All moneys paid into the account are available without regard to fiscal years, for expenditure by the state board in accordance with the provisions of this article.

13441.5. The State Treasurer, when requested by the state board and approved by the Director of Finance, shall transfer moneys in the nature of a loan from the State Water Quality Control Fund to the account created pursuant to Section 13440, which shall be repayable from the account to such fund; provided, that the moneys transferred from the fund to the account shall not exceed the sum of twenty-five thousand dollars ($25,000) at any one time.

(Added by Stats. 1970, Ch. 918.)

13442. Upon application by a public agency with authority to clean up a waste or abate the effects thereof, the state board may order moneys to be paid from the account to the agency to assist it in cleaning up the waste or abating its effects on waters of the state. The agency shall not become liable to the state board for repayment of such moneys, but this shall not be any defense to an action brought pursuant to subdivision (b) of Section 13304 for the recovery of moneys paid hereunder.

NOTE. This article is subject to Government Code provisions on oil spills. (See page 60.)

CHAPTER 7. WATER RECLAMATION

Article 1. Short Title

13500. This chapter shall be known as and may be cited as the Water Reclamation Law.

Article 2. Declaration of Policy

13510. It is hereby declared that the people of the state have a primary interest in the development of facilities to reclaim water containing waste to supplement existing surface and underground water supplies and to assist in meeting the future water requirements of the state.

13511. The Legislature finds and declares that a substantial portion of the future water requirements of this state may be economically met by beneficial use of reclaimed water.

The Legislature further finds and declares that the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife purposes will contribute to the peace, health, safety and welfare of the people of the state. Use of reclaimed water constitutes the development of "new basic water supplies" as that term is used in Chapter 5 (commencing with Section 12880) of Part 6 of Division 6.

13512. It is the intention of the Legislature that the state undertake all possible steps to encourage development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the state.

Article 3. State Assistance

13515. In order to implement the policy declarations of this chapter, the state board is authorized to provide loans for the development of water reclamation facilities, or for studies and investigations in connection with water reclamation, pursuant to the provisions of Chapter 6 (commencing with Section 13400) of this division.

Article 4. Regulation of Reclamation

13520. As used in this article "reclamation criteria" are the levels of constituents of reclaimed water, and means for assurance of reliability under the design concept which will result in reclaimed water safe from the standpoint of public health, for the uses to be made.

13521. The State Department of Health shall establish statewide reclamation criteria for each varying type of use of reclaimed water where such use involves the protection of public health.

13522 Whenever the State Department of Health or any local health officer finds that a contamination exists as a result of use of reclaimed water, the department or local health officer shall order the contamination abated in accordance with the procedure provided for in Chapter 6 (commencing with Section 5400) of Part 3, Division 5 of the Health and Safety Code.

13522.5. (a) Any person reclaiming or proposing to reclaim water or using or proposing to use reclaimed water within any region for any purpose for which reclamation criteria have been established, shall file with the regional board of that region a report containing such information as may be required by the board.

(b) Every person reclaiming water or using reclaimed water shall file with the regional board of that region a report of any material change or proposed change in the character of the reclaimed water or its use.

(c) Each report under this section shall be sworn to or submitted under penalty of perjury.

(d) The provisions of this section shall not be construed so as to require any such report in the case of any producing, manufacturing, or processing operation involving the reclamation of water solely for use in such producing, manufacturing or processing operation.

(Added by Stats. 1970, Ch. 918.)

13522.6. Any person failing to furnish a report under Section 13522.5 when so requested by a regional board is guilty of a misdemeanor.

(Added by Stats. 1970, Ch. 918.)

13522.7. The Attorney General, at the request of the regional board, shall petition the superior court for the issuance of a temporary restraining order, temporary injunction or permanent injunction, or combination thereof, as may be appropriate, requiring any person not complying with Section 13522.5 to comply forthwith.

(Added by Stats. 1970, Ch. 918.)

13523. Each regional board, after consulting with and receiving the recommendations of the State Department of Health and after any necessary hearing, shall, if it determines such action to be necessary to protect the public health, safety, or welfare, prescribe water reclamation requirements for water which is used or proposed to be used as reclaimed water. Requirements may be placed upon the person reclaiming water, the user, or both. Such requirements shall include, or be in conformance with, the statewide reclamation criteria established pursuant to this article. The regional board may require the submission of a preconstruction report for the purpose of determining compliance with the reclamation criteria.

(Amended by Stats. 1970, Ch. 918.)

13524. No person shall reclaim water or use reclaimed water for any purpose for which reclamation criteria have been established until water reclamation requirements have been established pursuant to this article or a regional board determines that no requirements are necessary.

(Former 13525; amended and renumbered 13524 by Stats. 1970, Ch. 918.)

13525. Upon the refusal or failure of any person or persons reclaiming water or using reclaimed water to comply with the provisions of this article, the Attorney General, at the request of the regional board, shall petition the superior court for the issuance of a temporary restraining order, preliminary injunction, or permanent injunction, or combination thereof, as may be appropriate, prohibiting forthwith any person or persons from violating or threatening to violate the provisions of this article.

(Former 13524; amended and renumbered 13525 by Stats. 1970, Ch. 918.)

13525.5. Any person reclaiming water or using reclaimed water in violation of Section 13524, after such violation has been called to his attention in writing by the regional board, is guilty of a misdemeanor. Each day of such reclaiming or use shall constitute a separate offense.

(Added by Stats. 1970, Ch. 918.)

13526. Any person who, after such action has been called to his attention in writing by the regional board, uses reclaimed water for any purpose for which reclamation criteria have been established prior to the establishment of water reclamation requirements, is guilty of a misdemeanor.

13527. In administering any statewide program of financial assistance for water pollution or water quality control which may be delegated to it pursuant to Chapter 6 (commencing with Section 13400) of this division, the state board shall give added consideration to water quality control facilities providing optimum water reclamation and use of reclaimed water.

Nothing in this chapter prevents the appropriate regional board from establishing waste discharge requirements if a discharge is involved.

13528. No provision of this chapter shall be construed as affecting the existing powers of the State Department of Health.

Article 5. Surveys and Investigations

13530. The department, either independently or in cooperation with any person or any county, state, federal, or other agency, or on request of the state board, to the extent funds are allocated therefor, shall conduct surveys and investigations relating to the reclamation of water from waste pursuant to Section 230.

Article 6. Waste Well Regulation

13540. No person shall construct, maintain or use any waste well extending to or into a subterranean water-bearing stratum that is used or intended to be used as, or is suitable for, a source of water supply for domestic purposes. Notwithstanding the foregoing, when a regional board finds that water quality considerations do not preclude controlled recharge of such stratum by direct injection, and when the State Department of Health, following a public hearing, finds the proposed recharge will not impair the quality of water in the receiving aquifer as a source of water supply for domestic purposes, reclaimed water may be injected by a well into such stratum. The State Department of Health may make and enforce such regulations pertaining thereto as it deems proper. Nothing in this section shall be construed to affect the authority of the state board or regional boards to prescribe and enforce requirements for such discharge.

13541. As used in this article, "waste well" includes any hole dug or drilled into the ground, used or intended to be used for the disposal of waste.

CHAPTER 8. FEDERAL ASSISTANCE FOR TREATMENT FACILITIES

13600. The state board shall administer any program of financial assistance for water quality control which may be delegated to it by law, and may accept funds from the United States or any person to that end.

13601. The state board, in cooperation with the regional boards, shall survey the statewide need for waste collection, treatment and disposal facilities which will be required during the five-year period, January 1, 1968, to December 31, 1972, inclusive, to adequately protect the waters of the state for beneficial use. The state board shall also, biennially, commencing in 1970, survey the need for facilities which will be required by public agencies for the ensuing five-year period. The state board may request a local public agency operating such facilities to transmit to its regional board a report on the following:

(a) A summary of the construction or improvement of its waste collection, treatment and disposal facilities and amounts expended therefor.

(b) An estimate of its needs for the five-year period, January 1, 1968, to December 31, 1972, inclusive, and for any ensuing five-year period.

The state board shall review the information contained in the reports made by the local public agencies. The state board shall submit to the Legislature findings and conclusions as to the anticipated local, state, and federal financing necessary to provide the needed facilities for such periods.

13602. The state board shall make no commitment or enter into any agreement pursuant to an exercise of authority under this chapter until it has determined that any money required to be furnished as the state's share of project cost is available for such purpose.

13603. The Governor may request the funds required to finance the state's share of project costs for each fiscal year through inclusion of the anticipated state's share in the annual Budget Bill.

13604. The state board shall review and approve each waste collection, treatment, and disposal project for which an application for a grant under the Federal Water Pollution Control Act has been made. The state board shall, in reviewing each project, determine whether such project is in conformity with state policy for water quality control and in conformity with water quality control plans adopted by regional boards, and shall certify that such project is entitled to priority over other eligible projects on the basis of financial as well as water pollution control needs.

(Amended by Stats. 1970, Ch. 254.)

13605 For the purpose of reviewing applications for grants made pursuant to authority granted in Section 13600, the state board shall give added consideration to applicants having facilities providing optimum water reclamation and use of reclaimed water.

13606. If an application states that the applicant is not able to finance the local agency share of the project, the state board shall consider whether the applicant should be required to levy a sewerage service charge. If the state board determines a sewerage service charge is necessary to pay such costs, the state board shall not approve the grant application unless, as a condition to such approval, the applicant agrees to levy a reasonable and equitable sewerage service charge in connection with the proposed project.

Any such applicant, not otherwise authorized, is authorized by this section to levy a sewerage service charge pursuant to such an agreement, and shall levy such charge in the manner provided in the agreement.

13607. All money appropriated by the Legislature for the state's share of the project costs shall be appropriated without regard to fiscal years, or shall augment an appropriation without regard to fiscal years.

13608. After the effective date of the amendment of this section by the 1972 Regular Session of the Legislature, no application for a grant under this division or under the Federal Water Pollution Control Act, or amendment thereof, or for a loan pursuant to Chapter 6 (commencing with Section 13400) of this division, shall be accepted by the state board unless such application contains assurances that supervisors and operators of the plant meet or will meet certification requirements, adopted pursuant to Chapter 9 (commencing with Section 13625) of this division, for the proposed plant, as well as the plant in current operation.

(Amended by Stats. 1970, Ch. 918, and Stats. 1972, Ch. 1315.)

CHAPTER 13. CLEAN WATER BOND LAW OF 1970

(Added by Stats. 1970, Ch. 508, subject to referendum. Approved by vote at election held on November 3, 1970)

13970. This chapter may be cited as the Clean Water Bond Law of 1970.

13971. The Legislature hereby finds and declares that clean water, which fosters the health of the people, the beauty of their environment, the expansion of industry and agriculture, the enhancement of fish and wildlife, the improvement of recreational facilities and the provision of pure drinking water at a reasonable cost, is an essential public need. Although the State of California is endowed with abundant lakes and ponds, streams and rivers, and hundreds of miles of shoreline, as well as large quantities of underground water, these vast water resources are threatened by pollution, which, if not checked, will impede the state's economic, community and social growth. The chief cause of pollution is the discharge of inadequately treated waste into the waters of the state. Many public agencies have not met the demands for adequate waste treatment or the control of water pollution because of inadequate financial resources and other responsibilities. Increasing population accompanied by accelerating urbanization, growing demands for water of high quality, rising costs of construction and technological changes mean that unless the state acts now the needs may soar beyond the means available for public finance. Meeting these needs is a proper purpose of the federal, state and local governments. Local agencies, by reason of their closeness to the problem, should continue to have primary responsibility for construction, operation and maintenance of the facilities necessary to cleanse our waters. Since water pollution knows no political boundaries and since the cost of eliminating the existing backlog of needed facilities and of providing additional facilities for future needs will be beyond the ability of local agencies to pay, the state, to meet its responsibility to protect and promote the health, safety and welfare of the inhabitants of the state, should assist in the financing. The federal government is contributing to the cost of control of water pollution, and just provision should be made to cooperate with the United States of America. It is the intent of this chapter to provide necessary funds to insure the full participation by the state under the provisions of Section 8 of the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.) and acts amendatory thereof or supplementary thereto.

13972. The State General Obligation Bond Law is adopted for the purpose of the issuance, sale, and repayment of, and otherwise providing with respect to, the bonds authorized to be issued by this chapter, and the provisions of that law are included in this chapter as though set out in full in this chapter except that notwithstanding anything in the State General Obligation Bond Law, the bonds authorized hereunder shall bear such rates of interest, or maximum rates, as may from time to time be fixed by the State Treasurer, with the approval of the committee, and the maximum maturity of the bonds shall not exceed 50 years from the date of the bonds, or from the date of each respective series. The maturity of each respective series shall be calculated from the date of such series.

13973. As used in this chapter, and for the purposes of this chapter as used in the State General Obligation Bond Law, the following words shall have the following meanings:

(a) "Committee" means the Clean Water Finance Committee, created by Section 13974.

(b) "Board" means the State Water Resources Control Board.

(c) "Fund" means the State Clean Water Fund.

(d) "Municipality" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq.) and acts amendatory thereof or supplementary thereto and shall also include the state or any agency or department thereof.

(e) "Treatment works" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq.) and acts amendatory thereof or supplementary thereto.

(f) "Construction" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq.) and acts amendatory thereof or supplementary thereto.

(g) "Eligible project" means a project for the construction of treatment works which is all of the following:

(1) Eligible for federal assistance, whether or not federal funds are then available therefor;

(2) Necessary to prevent water pollution;

(3) Certified by the board as entitled to priority over other treatment works, and which complies with applicable water quality standards, policies and plans.

(h) "Federal assistance" means funds available to a municipality either directly or through allocation by the state, from the federal government as grants for construction of treatment works, pursuant to Section 8 of the Federal Water Pollution Control Act, and acts amendatory thereof.

13974. The Clean Water Finance Committee is hereby created. The committee shall consist of the Governor or his designated representative, the State Controller, the State Treasurer, the Director of Finance, and the chairman of the board. The executive officer of the board shall serve as a member of the committee in the absence of the chairman. Said committee shall be the "committee" as that term is used in the State General Obligation Bond Law.

13975. The committee is hereby authorized and empowered to create a debt or debts, liability or liabilities, of the State of California, in the aggregate amount of two hundred fifty million dollars ($250,000,000), in the manner provided in this chapter. Such debt or debts, liability or liabilities, shall be created for the purpose of providing the fund to be used for the object and work specified in Section 13976.

13976. (a) The moneys in the fund shall be used for the purposes set forth in this section.

(b) The board is authorized to enter into contracts with municipalities having authority to construct, operate and maintain treatment works, for grants to such municipalities to aid in the construction of eligible projects, and for reclamation of water.

Grants may be made pursuant to this section to reimburse municipalities for construction for which contracts were let subsequent to July 1, 1970, and before the first sale of bonds authorized to be issued by this chapter.

Any contract pursuant to this section may include such provisions as may be agreed upon by the parties thereto, and any such contract concerning an eligible project shall include, in substance, the following provisions:

(1) An estimate of the reasonable cost of the eligible project;

(2) An agreement by the board to pay to the municipality, during the progress of construction or following completion of construction as may be agreed upon by the parties, an amount which equals at least 12½ percent of the eligible project cost determined pursuant to federal and state laws, and regulations. Notwithstanding the provisions of any existing agreements entered into pursuant to this subdivision, the board shall pay to the municipality under any contract entered into pursuant to this subdivision for a project for which the federal grant offer was made on or after October 18, 1972, an amount which equals 12½ percent of the eligible project cost determined pursuant to federal and state law and regulations;

(3) An agreement by the municipality, (i) to proceed expeditiously with, and complete, the eligible project, (ii) to commence operation of the treatment works on completion thereof, and to properly operate and maintain such works in accordance with applicable provisions of law, (iii) to apply for and make reasonable efforts to secure federal assistance for the eligible project, (iv) to secure the approval of the board before applying for federal assistance in order to maximize the amounts of such assistance received or to be received for all eligible projects in the state, and (v) to provide for payment of the municipality's share of the cost of the eligible project.

(c) The board may make direct grants to any municipality or by contract or otherwise undertake plans, surveys, research, development and studies necessary, convenient or desirable to the effectuation of the purposes and powers of the board pursuant to this division and to prepare recommendations with regard thereto, including the preparation of comprehensive statewide or areawide studies and reports on the collection, treatment and disposal of waste under a comprehensive cooperative plan.

The aggregate amount of moneys which may be advanced or granted to or committed to municipalities for the purpose of planning, research and development, whether by the board or under the direction of the board or in the form of direct grants to municipalities for such purpose, shall not exceed in the aggregate such amount as may be fixed from time to time by the committee.

(d) The board may from time to time with the approval of the committee transfer moneys in the fund to the State Water Quality Control Fund to be available for loans to public agencies pursuant to Chapter 6 (commencing with Section 13400) of this division.

(e) Not more than one-half of 1 percent of the moneys deposited in the fund may be expended by the board for costs incurred in administering the provisions of this chapter.

(f) As much of the moneys in the fund as is necessary shall be used to reimbure the General Obligation Bond Expense Revolving Fund pursuant to Section 16724.5 of the Government Code.

(g) The board may with the approval of the committee transfer not more than ten million dollars ($10,000,000) from the fund to a special reserve fund as additional security for the payment of the principal of and the interest on revenue bonds sold by the state as provided by law to provide funds to municipalities for needed sewage facilities. Such money shall be used for such purpose only after all other securities provided by law have been exhausted. Any money not used for such purpose shall, after retirement of the revenue bonds, be returned to the fund and be available for other purposes provided for in this section.

(h) The board may adopt rules and regulations governing the making and enforcing of contracts pursuant to this section.

13977. All bonds herein authorized, which shall have been duly sold and delivered as herein provided, shall constitute valid and legally binding general obligations of the State of California, and the full faith and credit of the State of California is hereby pledged for the punctual payment of both principal and interest thereon.

There shall be collected annually in the same manner and at the same time as other state revenue is collected such a sum, in addition to the ordinary revenues of the state, as shall be required to pay the principal and interest on said bonds as herein provided, and it is hereby made the duty of all officers charged by law with any duty in regard to the collection of said revenue, to do and perform each and every act which shall be necessary to collect said additional sum.

All money deposited in the fund which has been derived from premium and accrued interest on bonds sold shall be available for transfer to the General Fund as a credit to expenditures for bond interest.

13978. All money deposited in the fund pursuant to any provision of law requiring repayments to the state for assistance financed by the proceeds of the bonds authorized by this chapter shall be available for transfer to the General Fund. When transferred to the General Fund such money shall be applied as a reimbursement to the General Fund on account of principal and interest on the bonds which has been paid from the General Fund.

13979. There is hereby appropriated from the General Fund in the State Treasury for the purpose of this chapter such an amount as will equal the following:

(a) Such sum annually as will be necessary to pay the principal of and the interest on the bonds issued and sold pursuant to the provisions of this chapter, as said principal and interest become due and payable.

(b) Such sum as is necessary to carry out the provisions of Section 13980, which sum is appropriated without regard to fiscal years.

13980. For the purpose of carrying out the provisions of this chapter, the Director of Finance may by executive order authorize the withdrawal from the General Fund of an amount or amounts not to exceed the amount of the unsold bonds which the committee has by resolution authorized to be sold for the purpose of carrying out this chapter. Any amounts withdrawn shall be deposited in the fund and shall be disbursed by the board in accordance with this chapter. Any moneys made available under this section to the board shall be returned by the board to the General Fund from moneys received from the sale of bonds sold for the purpose of carrying out this chapter.

13981. Upon request of the board, supported by a statement of the proposed arrangements to be made pursuant to Section 13976 for the purposes therein stated, the committee shall determine whether or not it is necessary or desirable to issue any bonds authorized under this chapter in order to make such arrangements, and, if so, the amount of bonds then to be issued and sold. Successive issues of bonds may be authorized and sold to make such arrangements progressively, and it shall not be necessary that all of the bonds herein authorized to be issued shall be sold at any one time.

13982. The committee may authorize the State Treasurer to sell all or any part of the bonds herein authorized at such time or times as may be fixed by the State Treasurer.

13983. All proceeds from the sale of bonds, except those derived from premiums and accrued interest, shall be available for the purpose provided in Section 13976, but shall not be available for transfer to the General Fund to pay principal and interest on bonds. The money in the fund may be expended only as herein provided.

CHAPTER 14. CLEAN WATER BOND LAW OF 1974 *

Article 1. Short Title, Legislative Declarations, and General Definitions

13985. This chapter may be cited as the Clean Water Bond Law of 1974.

13986. The Legislature hereby finds and declares that clean water, which fosters the health of the people, the beauty of their environment, the expansion of industry and agriculture, the enhancement of fish and wildlife, the improvement of recreational facilities and the provision of pure drinking water at a reasonable cost, is an essential public need. Although the State of California is endowed with abundant lakes and ponds, streams and rivers, and hundreds of miles of shoreline, as well as large quantities of underground water, these vast water resources are threatened by pollution, which, if not checked, will impede the state's economic, community and social growth. The chief cause of pollution is the discharge of inadequately treated waste into the waters of the state. Many public agencies have not met the demands for adequate waste treatment or the control of water pollution because of inadequate financial resources and other responsibilities. Increasing population accompanied by accelerating urbanization, growing demands for water of high quality, rising costs of construction and technological changes mean that unless the state acts now the needs may soar beyond the means available for public finance. Meeting these needs is a proper purpose of the federal, state and local governments. Local agencies, by reason of their closeness to the problem, should continue to have primary responsibility for construction, operation and maintenance of the facilities necessary to cleanse our waters. Since water pollution knows no political boundaries and since the cost of eliminating the existing backlog of needed facilities and of providing additional facilities for future needs will be beyond the ability of local agencies to pay, the state, to meet its responsibility to protect and promote the health, safety and welfare of the inhabitants of the state, should assist in the financing. The federal government is contributing to the cost of control of water pollution, and just provision should be made to cooperate with the United States of America. It is the intent of this chapter to provide necessary funds to insure the full participation by the state under the provisions of Title 11 of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) and acts amendatory thereof or supplementary thereto.

13987. The State General Obligation Bond Law is adopted for the purpose of the issuance, sale, and repayment of, and otherwise providing with respect to, the bonds authorized to be issued by this chapter, and the provisions of that law are included in this chapter as though set out in full in this chapter except that notwithstanding anything in the State General Obligation Bond Law, the bonds authorized hereunder shall bear such rates of interest, or maximum rates, as may from time to time be fixed by the State Treasurer, with the approval of the committee, and the maximum maturity of the bonds shall not exceed 50 years from the date of the bonds, or from the date of each respective series. The maturity of each respective series shall be calculated from the date of such series.

13988. As used in this chapter, and for the purposes of this chapter as used in the State General Obligation Bond Law, the following words shall have the following meanings:

(a) "Committee" means the Clean Water Finance Committee, created by Section 13989.

(b) "Board" means the State Water Resources Control Board.

(c) "Fund" means the State Clean Water Fund.

(d) "Municipality" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) and acts amendatory thereof or supplementary thereto and shall also include the state or any agency or department thereof.

(e) "Treatment works" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) and acts amendatory thereof or supplementary thereto.

(f) "Construction" shall have the same meaning as in the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) and acts amendatory thereof or supplementary thereto.

(g) "Eligible project" means a project for the construction of treatment works which is all of the following:

(1) Eligible for federal assistance, whether or not federal funds are then available therefor;

(2) Necessary to prevent water pollution;

(3) Certified by the board as entitled to priority over other treatment works, and which complies with applicable water quality standards, policies and plans.

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* Approved by voters, June 4, 1974 Primary Election

(h) "Federal assistance" means funds available to a municipality either directly or through allocation by the state, from the federal government as grants for construction of treatment works, pursuant to Title II of the Federal Water Pollution Control Act, and acts amendatory thereof.

13989. The Clean Water Finance Committee is hereby created. The committee shall consist of the Governor or his designated representative, the State Controller, the State Treasurer, the Director of Finance, and the chairman of the board. The executive officer of the board shall serve as a member of the committee in the absence of the chairman. Said committee shall be the "committee" as that term is used in the State General Obligation Bond Law.

13990. The committee is hereby authorized and empowered to create a debt or debts, liability or liabilities, of the State of California, in the aggregate amount of two hundred fifty million dollars ($250,000,000), in the manner provided in this chapter. Such debt or debts, liability or liabilities, shall be created for the purpose of providing the fund to be used for the object and work specified in Section 13991.

13991. (a) The moneys in the fund shall be used for the purposes set forth in this section.

(b) The board is authorized to enter into contracts with muincipalities having authority to construct, operate and maintain treatment works, for grants to such municipalities to aid in the construction of eligible projects, and for reclamation of water.

Grants may be made pursuant to this section to reimburse municipalities for construction for which contracts were let subsequent to July 1, 1970, and before the first sale of bonds authorized to be issued by this chapter.

Any contract pursuant to this section may include such provisions as may be agreed upon by the parties thereto, and any such cortract concerning an eligible project shall include, in substance, the following provisions:

(1) An estimate of the reasonable cost of the eligible project;

(2) An agreement by the board to pay to the municipality, during the progress of construction or following completion of construction as may be agreed upon by the parties, an amount which equals at least 12½ percent of the eligible project cost determined pursuant to federal and state laws, and regulations;

(3) An agreement by the municipality, (i) to proceed expeditiously with, and complete, the eligible project, (ii) to commence operation of the treatment works on completion thereof, and to properly operate and maintain such works in accordance with applicable provisions of law, (iii) to apply for and make reasonable efforts to secure federal assistance for the eligible project, (iv) to secure the approval of the board before applying for federal assistance in order to maximize the amounts of such assistance received or to be received for all eligible projects in the state, and (v) to provide for payment of the municipality's share of the cost of the eligible project.

(c) The board may make direct grants to any municipality or by contract or otherwise undertake plans, surveys, research, development and studies necessary, convenient or desirable to the effectuation of the purposes and powers of the board pursuant to this division and to prepare recommendations with regard thereto, including the preparation of comprehensive statewide or areawide studies and reports on the collection, treatment and disposal of waste under a comprehensive cooperative plan.

The aggregate amount of moneys which may be advanced or granted to or committed to municipalities for the purpose of planning, research and development, whether by the board or under the direction of the board or in the form of direct grants to municipalities for such purpose, shall not exceed in the aggregate such amount as may be fixed from time to time by the committee.

(d) The board may from time to time with the approval of the committee transfer moneys in the fund to the State Water Quality Control Fund to be available for loans to public agencies pursuant to Chapter 6 (commencing with Section 13400) of this division.

(e) Not more than one-half of one percent of the moneys deposited in the fund may be expended by the board for costs incurred in administering the provisions of this chapter.

(f) As much of the moneys in the fund as is necessary shall be used to reimburse the General Obligation Bond Expense Revolving Fund pursuant to Section 16724.5 of the Government Code.

(g) The board may adopt rules and regulations governing the making and enforcing of contracts pursuant to this section.

13992. All bonds herein authorized, which shall have been duly sold and delivered as herein provided, shall constitute valid and legally binding general obligations of the State of California, and the full faith and credit of the State of California is hereby pledged for the punctual payment of both principal and interest thereon.

There shall be collected annually in the same manner and at the same time as other state revenue is collected such a sum, in addition to the ordinary revenues of the state, as shall be required to pay the principal and interest on said bonds as herein provided, and it is hereby made the duty of all officers charged by law with any duty in regard to the collection of said revenue, to do and perform each and every act which shall be necessary to collect said additional sum.

All money deposited in the fund which has been derived from premium and accrued interest on bonds sold shall be available for transfer to the General Fund as a credit to expenditures for bond interest.

13993. All money deposited in the fund pursuant to any provision of law requiring repayments to the state for assistance financed by the proceeds of the bonds authorized by this chapter shall be available for transfer to the General Fund. When transferred to the General Fund such money shall be applied as a reimbursement to the General Fund on account of principal and interest on the bonds which has been paid from the General Fund.

13994. There is hereby appropriated from the General Fund in the State Treasury for the purpose of this chapter such an amount as will equal the following:

(a) Such sum annually as will be necessary to pay the principal of and the interest on the bonds issued and sold pursuant to the provisions of this chapter, as said principal and interest become due and payable.

(b) Such sum as is necessary to carry out the provisions of Section 13995, which sum is appropriated without regard to fiscal years.

13995. For the purpose of carrying out the provisions of this chapter, the Director of Finance may by executive order authorize the withdrawal from the General Fund of an amount or amounts not to exceed the amount of the unsold bonds which the committee has by resolution authorized to be sold for the purpose of carrying out this chapter. Any amounts withdrawn shall be deposited in the fund and shall be disbursed by the board in accordance with this chapter. Any moneys made available under this section to the board shall be returned by the board to the General Fund from moneys received from the sale of bonds sold for the purpose of carrying out this chapter.

13996. Upon request of the board, supported by a statement of the proposed arrangements to be made pursuant to Section 13991 for the purposes therein stated, the committee shall determine whether or not it is necessary or desirable to issue any bonds authorized under this chapter in order to make such arrangements, and, if so, the amount of bonds then to be issued and sold. Successive issues of bonds may be authorized and sold to make such arrangements progressively, and it shall not be necessary that all of the bonds herein authorized to be issued shall be sold at any one time.

13997. The committee may authorize the State Treasurer to sell all or any part of the bonds herein authorized at such time or times as may be fixed by the State Treasurer.

13998. All proceeds from the sale of bonds, except those derived from premiums and accrued interest, shall be available for the purpose provided in Section 13991 but shall not be available for transfer to the General Fund to pay principal and interest on bonds. The money in the fund may be expended only as herein provided.

OTHER LEGISLATION RELATED TO WATER QUALITY CONTROL

Government Code:

Oil Spills

8574.1. In addition to any other authority conferred upon the Governor by this chapter, the Governor may establish a state oil spill contingency plan pursuant to the provisions of this article.

8574.2. Any plan established pursuant to this article shall provide for an integrated and effective state procedure to combat the results of major oil spills within the state. Such plan shall provide for specified state agencies to implement the plan.

8574.3. State agencies granted authority to implement a plan adopted under this article shall have the authority to use volunteer workers. Such volunteers shall be deemed employees of the state for the purpose of workmen's compensation under Article 2 (commencing with Section 3350) of Chapter 2 of Part 1 of Division 4 of the Labor Code. Any payments for workmen's compensation under this section shall be made from the account specified in Section 8574.4.

8574.4. State agencies designated to implement the contingency plan shall account for all state expenditures made under the plan with respect to each oil spill. Expenditures accounted for under this section shall be paid for from the State Water Pollution Cleanup and Abatement Account of the State Water Quality Control Fund provided for in Article 3 (commencing with Section 13440) of Chapter 6 of Division 7 of the Water Code. If the party responsible for the spill is identified, that party shall be liable for the expenditures accounted for under this section, in addition to any other liability which may be provided for by law, in an action brought by the Attorney General. The proceeds from any such action shall be paid into the State Water Pollution Cleanup and Abatement Account of the State Water Quality Control Fund.

(Added by Stats. 1972, Ch. 1325.)

Solid Waste Board

Sections 66700–66750—The Nejedly-Z'berg-Dills Solid Waste Management and Resource Recovery Act of 1972 sets up a new State Solid Waste Management Board in the Resources Agency to begin not later than May 1973.

Harbors and Navigation Code:

Oil Deposits

§ 151.

Except where permitted pursuant to the provisions of Chapter 4 (commencing with Section 13200) of Division 7 of the Water Code, any person that intentially or negligently causes or permits any oil to be deposited in the water of this state, including but not limited to navigable waters, shall be liable civilly in an amount not exceeding six thousand dollars ($6,000) and, in addition, shall be liable to any governmental agency charged with the responsibility for cleaning up or abating any such oil for all actual damages, in addition to the reasonable costs actually incurred in abating or cleaning up the oil deposit in such waters. The amount of the civil penalty which is assessed pursuant to this section shall be based upon the amount of discharge and the likelihood of permanent injury and shall be recoverable in a civil action by, and paid to, such governmental agency. If more than one such agency has responsibility for the waters in question, the agency which conducts the cleaning or abating activities shall be the agency authorized to proceed under this section.

(Added by Stats. 1968, c. 1250. Amended by Stats. 1971, c. 438.)

§ 152.

The agency cleaning up the oil deposit shall notify, in writing, the appropriate regional water quality control board of the nature of the deposit and of the corrective action taken or contemplated.

(Added by Stats. 1968, c. 1259.)

Health and Safety Code:

Pollution Control Financing

Sections 39600–39643—The California Pollution Control Financing Authority Act creates a new authority to assist industry in financing pollution control devices, equipment and facilities.

Hazardous Waste

Sections 25100–25185—Directs the State Department of Public Health to adopt new regulations for the handling, processing and disposal of hazardous wastes.

Public Resources Code:

Environmental Quality

Sections 21060–21174—Defines terms as used in the Environmental Quality Act of 1970 to clarify existing law, particularly the requirement for state agencies to prepare environmental impact statements.

Proposition 20, the Coastal Zone Initiative

(Approved by the Voters of California Nov. 7, 1972)

Permits and Planning

Sections 27000–27650—Creates a State Coastal Zone Conservation Commission and six regional commissions, each to hold first meetings by early February, 1973. Any development (very broadly defined) within 1000 yards of mean high tide line requires an interim commission permit consistent with reservation of recreation and wildlife preserves, structures that will minimize adverse effect to scenic resources or from floods or siltation. As a rule, residential repairs of less than $7,500 exempt. Pipelines to discharge Porter-Cologne regulated wastes will be subject to interim permit requirements. The California Coastal Zone Conservation Plan, applicable to nearly all of the coastal watershed, shall be adopted by December 1, 1975. The act terminates after 1976.

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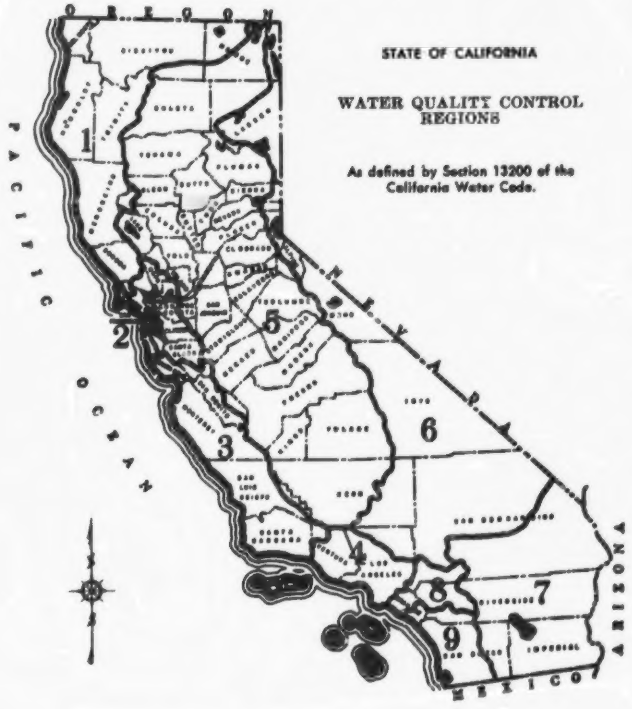

STATE OF CALIFORNIA

WATER QUALITY CONTROL REGIONS

As defined by Section 13200 of the California Water Code.

TENTATIVE

WATER QUALITY CONTROL PLAN
SAN FRANCISCO BAY BASIN (2)

PART I

November 1974

STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION (2)

RECOMMENDED WATER QUALITY OBJECTIVES

To provide a rational basis for water quality planning, it is necessary for quality to be described in quantitative terms which, in turn, may be used in the evaluation of alternate planning approaches for meeting established goals. Such quantitative values are normally referred to as "criteria" for judging a water's suitability for specific beneficial uses. Acceptable water quality characteristics have been defined for most beneficial uses. Criteria which are required for the protection of beneficial uses and are achievable by practical means usually are adopted as formal water quality objectives.

Water quality objectives set forth in the plan are those necessary to protect present and probably future beneficial uses within the basin. These water quality objectives are implemented through the establishment of of waste discharge requirements by the Regional Board and other implementation provisions in the plan.

The beneficial uses and water quality objectives set forth in this plan apply to general areas. The Regional Board, in setting waste discharge requirements, will consider the particular impact on beneficial uses within the immediate area of influence of the discharge, the existing quality of receiving waters, and water quality objectives. This consideration includes (1) enumeration of the beneficial uses potentially effected by the waste discharge, (2) impact of the discharge on existing beneficial uses, (3) receiving water quality, and (4) the water quality objectives. The Regional Board will make a finding as to the beneficial uses within the area of influence of the discharge and set waste discharge requirements to protect these uses while not allowing the discharge to violate receiving water quality objectives.

Recommended water quality objectives presented in this chapter apply to waters within the Region 2 boundary while those objectives which pertain specifically to the portion of Basin 2 under the jurisdiction of Region 5 are specified in Appendix E of this report.

In succeeding sections of this chapter planning approaches employed in the development of a water quality control plan for San Francisco Bay Basin are presented followed by a discussion of recommended water quality objectives. Water quality parameters which are useful in plan evaluation but are not recommended as water quality objectives with legal stature are retained as water quality planning criteria.

Effluent limitation and discharge prohibitions arising out of application of these receiving water quality criteria and objectives are presented in Chapter 5.

BASIS FOR SELECTION OF WATER QUALITY OBJECTIVES

The establishment of water quality objectives, as with other aspects of water quality control planning, has become more complex in recent years because of increasing levels of protection demanded, largely as a result of increased public awareness of the benefits associated with a clean and healthy environment. Few uses can be made of natural waters without some impairment in quality and, as a consequence, impairment of its value for subsequent use. From this standpoint, criteria and objectives should be more than a list of values representing maximum limits for various impurities. More importantly, they should include statements describing appropriate water quality for each use, permitting goals (objectives) to be established for individual water use.

For each water use a set of water quality criteria is set forth, from these, recommended water quality objectives have been determined. Such objectives describe the level of water quality which should exist at all times. In establishing relevant objectives, consideration must be given to the expected water uses, any adverse effects of not attaining the established objectives, the capability of controlling water quality to permit all expected uses, and the administrative and institutional aspects of water quality control. Water quality resulting from attainment of the established objectives should be sufficiently high to insure protection for all designated current and future beneficial uses.

Beneficial Uses

As the initial step in development of water quality objectives for San Francisco Bay Basin beneficial uses were defined for various receiving water segments (Chapter 2). A brief description of the most important quality requirements for beneficial water uses is presented below.

Water Supply

The various beneficial uses involving water supply include municipal and domestic supply, agricultural supply, industrial process supply, industrial service supply, groundwater recharge, navigation and hydroelectric power generation. The first four uses involve withdrawal of water for use. Groundwater recharge operations are often undertaken with a view to future withdrawal of increased quantities and for protection of water quality. Navigation and hydroelectric power generation are special uses that use water in a commercial sense without actual consumption. While these uses can affect the quality of waters they utilize, they have few significant quality requirements of their own.

Domestic and Municipal Water Supply (MUN)

The principal issues involving municipal water supply quality are (1) protection of the public health, (2) aesthetic acceptability of the product, and (3) the economic impacts associated with treatment or quality related damages. The health aspects broadly relate to direct disease transmission, toxic effects and increased susceptibility to disease. Common examples include the possibility of developing typhoid fever and cholera from ingestion of contaminated water, links between nitrate and methemoglobinemia, and undefined but alleged relationships between sodium and heart disease or exotic organic compounds and cancer. Acceptance varies widely depending on the nature of the supply source with which people have become accustomed, however, parameters of general concern are excessive hardness, unpleasant odor or taste, turbidity or color. In each case it is possible to improve acceptability by treatment. The cost of doing so may not be economically justified when alternative water supply sources of suitable quality are available.

There are published water quality objectives that give limits for known health-related constituents and most properties affecting public acceptance. These objectives for drinking water include the 1962 U.S. Public Health Drinking Water Standards, the California State Health Department criteria. Another set, prepared by the National Technical Advisory Committee (NTAC)[1] in 1973 lists surface water criteria for public water supply prior to treatment.

Agricultural Supply (AGR)

Agricultural water supplies are used for farmstead uses, livestock watering and irrigation. Farmstead uses are best protected by adherence to criteria previously discussed under municipal and domestic water supply. The quality of livestock water supply requires consideration of relationships of water to the total diet including water freely drunk and moisture content of feed, and interactions between irrigation water quality and the quality of feed. The Basin Contractor's Advisory Subcommittee on Water Quality Objectives developed threshold and limiting concentrations for livestock water; these are based on the NTAC criteria and technical literature reviews contained in the Second Edition of *Water Quality Criteria* by McKee and Wolf.[2]

Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are soluble salt accumulations, chemical changes in the soil, toxicity to crops, and potential disease transmission to man. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these hazards.

Industrial Process Supply (PROC)

Water quality requirements differ widely for the many industrial processes in use today. There are so many specific industrial processes with so many different water quality requirements for actual use that no meaningful criteria can be established generally for quality of raw water supplies. Fortunately, this is not a perplexing shortcoming, since current water treatment technology can create desired product waters tailored for specific uses. The NTAC report has summarized raw water quality characteristics used for various industrial categories and suggested criteria at the point of use for certain industrial uses.

Industrial Service Supply (IND)

Most industrial service supplies, such as water used in mining, gravel washing, fire protection or hydraulic conveyance have essentially no water quality limitations except gross constraints such as freedom from unusual debris. Cooling water requirements have been developed by the NTAC.

Groundwater Recharge (GWR)

The requirements for groundwater recharge operations generally reflect the future use to be made of the water stored undergorund. In some cases recharge operations may be conducted to prevent seawater intrusion; in these cases the quality of recharged waters may not directly affect quality at the well-field being protected. Recharge operations are often limited by excessive suspended sediment or turbidity that can clog the surface or recharge pits, basins or wells.

Under the State policy for nondegradation of water resources the quality of some of the waters of the state are higher than established by adopted policies, and it is the intent of this policy that existing higher quality be maintained to the maximum extent possible. Requirements for groundwater recharges, therefore, shall impose the best practicable treatment technology or control of the discharge as necessary to assure the highest quality consistent with maximum benefit to the people of the state.

Navigation (NAV)

Commercial and military shipping influence water quality but do not demand high quality water for their normal operations. Physical hazards to navigation, including debris or submerged objects, are of concern. Interestingly, some port structures, including wood piling have suffered structural damage from borers following improvements to water quality. Barnacles and other hull-fouling organisms that may proliferate in marine areas can be killed when ships are docked in freshwater ports. (In the days of wooden sailing ships, sea captains took advantage of this cleaning effect of freshwater.)

Recreational Uses

There are three categories of water related recreational use, including water contact recreation, noncontact water recreation, and sport and commercial ocean fishing. These uses rely on safe, aesthetically pleasing water and on protection of fresh and salt water aquatic life habitats that support fish production. Some specific water quality factors can be identified for each of these recreational uses of water.

Water Contact Recreation (REC 1)

Water contact implies a risk of water-borne disease transmission and involves human safety; accordingly, criteria required to protect this use are more stringent than those for more casual water-oriented recreation. Criteria for recreation areas have been described in the NTAC report. A special subcommittee for the State Board's Office of Technical Coordination developed tentative guidelines for evaluating the quality of water for water contact sports in both fresh and salt waters, and whereas they are generally consistent with the NTAC recommendations, they also include additional factors related to suspended solids, surfactants, oil, color and odor. One major difference is the absence in the State's report of a maximum value for fecal coliform bacteria.

Many studies have been made of water quality in recreation areas, however, very few have demonstrated a direct correlation between recreational water use and disease transmission. The NTAC report cites three U.S. Public Health Service epidemiological studies that were used as the basis for setting the committee's criteria. Though they were not definitive studies, the committee felt that detectable health effects may occur at a fecal coliform level of about 400 per 100 ml. A pH criterion that was included was intended to prevent or minimize eye irritation.

Some of the problems accompanying excessive algal growth have reduced the value of shoreline recreation area, particularly for swimming. Where algae growths exist in nuisance proportions, particularly blue-green algae, all recreational water uses including those related to fish protection tend to suffer.

Nuisance from algal growths has been related to social acceptability through public opinion surveys. Although criteria have been proposed to limit nutrient additions, conditions in the San Francisco Bay system indicate that nutrients are not the growth limit factor. Presently, it is believed that light penetration which is related to turbidity is controlling. A more appropriate criteria to protect the aesthetic quality of waters used for recreation is based on chlorophyll a.

concentrations of chlorophyll *a* not to exceed 50 micrograms per liter have been proposed for clear waters.

Non-contact Water Recreation (REC-2)

Water quality considerations relevant to noncontact water such as hiking, camping or boating and those related to tide pool or other nature studies require protection of habitats and aesthetic features. In some cases preservation of a natural wilderness condition is justified particularly where nature study is a major dedicated use.

Ocean Commercial and Sport Fishing (COMM)

The maintenance of ocean fishing relies mostly on the protection of aquatic life habitats where fish reproduce and seek their food. Protection of habitats is discussed in the succeeding sections.

Aquatic Life Habitats

The support of aquatic life systems and the uses that depend on the presence of acceptable habitats is a major challenge; the recent amendments to the Federal Water Pollution Control Act (PL 92-500) direct early attention to aquatic life protection. Criteria for protection of aquatic life are numerous and defy simple tabulations since interrelationships are complex and vary with the sensitivity of life forms found in different ecosystems. However, some of the broader divisions of habitat and certain special protection needs have been identified in the following eight beneficial use categories.

Warm Freshwater Habitat (WARM)

The warm freshwater habitats supporting bass, bluegill, perch and other panfish are generally lakes and reservoirs, although some minor streams will serve this purpose where streamflow is sufficient to sustain the fishery. This habitat is less sensitive to environmental changes than the cold freshwater habitat and natural fluctuations in temperature, dissolved oxygen, pH and turbidity are usually greater. Criteria considered relevant to warm water biota and their habitas have been described by NTAC.

Cold Freshwater Habitat (COLD)

Cold freshwater water habitats generally support trout, and may support the anadromous salmon and steelhead fisheries as well. Cold water habitats are commonly well oxygenated. Life within these waters is relatively intolerant to environmental stresses. Often the cold water habitas are fed by soft waters; the lack of buffering capacity of these waters renders fish more susceptible to toxic metals such as copper. Criteria have been recommended by NTAC for cold water habitats.

Wildlife Habitats (WILD)

The water quality requirements of wildlife pertain to the water directly used for ingestion, or the aquatic habitat itself, and the effect of water quality on the production of food materials. Waterfowl habitat is particularly sensitive to pollutional changes; but habitats acceptable to waterfowl are likely to be acceptable for other wildlife.[3] Some of the quality characteristics of particular importance in waterfowl habitat are dissolved oxygen, pH, alkalinity, salinity, turbidity, settleable matter, oil, toxicants and specific disease organisms.

Dissolved oxygen is needed in waterfowl habitats to suppress development of botulinus organisms; botulism has killed millions of waterfowl. Maintenance of adequate circulation and aerobic conditions are particularly important in shallow fringe areas of ponds or reservoirs where botulism has caused problems. Recommendations have been made by NTAC for the water quality of wildlife habitats.

Preservation of Rare and Endangered Species (RARE)

Water quality criteria to be achieved to encourage development and protection of rare or endangered species should be the same as those for protection of fish and wildlife habitats generally. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment and maintenance of particular quality criteria, which may vary slightly with the environmental needs of each particular species. Criteria for species using areas of special biological significance, ASBS, should likewise be derived from the general criteria for habitat types involved, with special management diligence given where required.

Marine Habitat (MAR)

The protection of marine habitat in many cases will be accomplished by measures to protect wildlife habitat generally, but criteria may be necessary for waterfowl marshes and other habitats such as those for shellfish and marine fishes. Some marine habitats, such as importent intertidal zones and kelp beds, and may require special protection. Water quality requirements for some individual marine species are admittedly not well known.

Fish Migration (MIGR)

Anadromous fish protection is generally assured by provisions of water quality acceptable to cold water fishes; however, particular attention must be given to maintenance of zones of passage. Any barrier to migration or free movement of migratory fish is harmful. Natural tidal movement in estuaries and unimpeded river flows are necessary for sustenance of migratory fishes and their offspring. A water quality barrier, whether thermal or chemical, can destroy the integrity of the migration route and lead to rapid decline of dependent fisheries.

Water quality may vary through a zone of passage as a result of natural or man-induced activities. Fresh water entering estuaries may float on the surface of the denser salt water or hug one shore as a result of density differences related to water temperature, salinity or suspended matter. The NTAC report has suggested that acceptable water quality migration zones should include at least 75 percent of the cross-sectional area of the waterway.

Fish Spawning (SPWN)

Dissolved oxygen levels in spawning areas should ideally approach saturation levels. Free movement of water is essential to maintain well oxygenated conditions around eggs deposited in sediments. Water temperature, size distribution and organic content of sediments, water depth, and current velocity are also important determinants of adequacy of spawning areas.

Shellfish Harvesting (SHELL)

Shellfish areas require protection for continuation of the resource and protection of public health. Usually the public health aspect is emphasized in water quality criteria statements, however, there are cases of shellfisheries being essentially eliminated by changes in water quality. Oysters diminished in San Francisco Bay after large volumes of suspended sediments were added to the Bay by the onset of hydraulic mining in the Mother Lode country. Crab declines have been related by some biologists with industrial waste disposal and to pesticides such as DDT.

Transmission of disease and direct poisoning of humans are of considerable concern in shellfish regulation. Bacteriological criteria for the open ocean, bays, and estuarine waters utilized for shellfish cultivation and harvesting should conform with the standards described in the National Shellfish Sanitation Program, Manual of Operation.

Buildup of toxic metals occurs in shellfish. Poisoning of shellfish consumers is a major concern in water pollution control. Mercury and cadmium are two metals known to have caused extremely disabling effects in humans consuming shellfish which concentrated these elements from industrial waste discharges. Other elements, radioactive isotopes and certain toxins produced by particular plankton species also concentrate in shellfish tissue. Although these are matters of concern, documented cases of human poisoning by shellfish contaminated with metals or other toxins are very rare in California.

In the preceding narrative reference was made to the National Technical Advisory Committee on Water Quality Criteria throughout the text and to the committee established by the State Board to develop water quality guidelines and criteria. The State Board has drawn on these and other references in developing a set of guidelines prepared by the Office of Technical Coordination for Basin Contractors to evaluate the quality of water required for various beneficial uses.

Table 4 1 presents the quality criteria of some of the beneficial uses based on State Board Management Memo 20. Numerical water quality requirements are not given for GWR, NAV, or REC 2 since quality requirements for other uses given in TAble 4 1 are more restrictive and thus are satisfactory for these uses. Criteria are not tabulated for beneficial uses related to aquatic life habitat because criterion values given in the management memo were taken from a variety of sources, some of which are inadequately supported or conflict with more recent judgements of appropriate limiting values. Proposed criteria for aquatic life habitat protection are discussed in the following section.

Values listed in Table 4 1 are 90 percentile values. Two values are given for municipal supply

Table 5-1. Water Quality Criteria for Beneficial Uses[a]

Parameter	MUN	AGR
Physical		
Color (units)	15/-	-
Odor (number)	3/-	-
Temperature	-	-
Turbidity (JTU)	5/-	-
Suspended solids (mg/l)	-	-
Transparency (feet)[b]	-	-
Inorganic constituents		
Total alkalinity (mg/l)	-	-
Aluminum (mg/l)	-	5/20
Arsenic (mg/l)	-	.1/2.0[c]
Ammonia (mg/l)[d]	-	-
Barium (mg/l)	1.0	-
Beryllium (mg/l)	.1/.5	-
Boron (mg/l)	1.0	0.5/2-10
Chloride (mg/l)	250/1,000	70/300-1,000
Chlorine (mg/l)[e]		
Cadmium (mg/l)	.01	.01/.05
Chromium (mg/l)	.05	.10/1.0
Cobalt	-	-
Carbon dioxide (mg/l)	-	-
Copper (mg/l)	1.0/-	0.2/5.0
Cyanide (mg/l)	.01/0.2	-
Fluoride (mg/l)	0.6-1.7	1.0/15.0[c]
CaCO$_3$ (mg/l)	500/-	-
Iron (mg/l)	0.3	5.0/20.0
Lead (mg/l)	0.05	5.0/10.0
Lithium (mg/l)	-	2.5
Manganese (mg/l)	0.05/-	0.2/10.0
Mercury (mg/l)	0.005	-
Molybdenum	-	0.01/0.05
Nickel (mg/l)	-	0.2/2.0
$NO_3 + NO_2$ (mg/l as N)	10	-
pH (units)	6.0-8.5	5.5-8.3/ 4.5-9.0
Selenium (mg/l)	0.01	0.02
Inorganic constituents		
Silver (mg/l)	0.05	-
Sodium absorption ratio	-	4.0/10-20
Sulfate (mg/l)	250/500	-
Sulfide (mg/l)	-	-
TDS (mg/l)	500/1,500	-
EC (mmhos)	-	-
Uranyl ion (mg/l)	5	-
Vanadium (mg/l)	-	0.10/1.0
Zinc (mg/l)	5/-	2.0/10.0
Organic constituents		
MBAS (mg/l)	0.05/0.5	-
Oil and grease (mg/l)	f	-
Phenols (mg/l)	0.001/-	
PCB's (mg/l)	-	-
Phthalate esters (mg/l)	-	-
ABS (mg/l)	-	-
Carbon alcohol extract (mg/l)	3	-
Carbon chloroform extract (mg/l)	0.15	-
COD	-	-
LAS	-	-
Biological properties		
Total coliform (per 100 ml)	100/10,000	5,000/-
Fecal coliform (per 100 ml)	20/2,000	1,000/-
Dissolved oxygen (mg/l)	-	-
Radioactivity		
Gross beta (pc/l)	1,000	1,000
Radium 226 (pc/l)	3	3
Strontium 90 (pc/l)	10	10

[a] Where two values appear (e.g., a/b), the first number represents a threshold concentration and the second represents a limiting concentration. All single numbers represent limiting concentrations. Limiting concentrations are suggested as 90 percentile limits, not to be violated by controllable factors more than 10 percent of the time.

[b] As measured by Secchi disc or expressed as percent light transmittance at prescribed depth.

[c] Concentrations for water used by livestock are more stringent. They are arsenic 0.05/1.0 and fluoride 1.0/5.0.

[d] Ammonia, expressed as undissociated NH_3OH.

[e] Residual chlorine.

[f] Virtually absent.

(MUN), agricultural supply (AGR), and water contact recreation activities (REC-1). One value is a threshold level and the other is a limiting concentration. The threshold levels are as follows:

MUN—The concentration at which treatment in addition to disinfection must be provided.

AGR—The concentration at which the irrigator may consider corrective measures.

REC-1—The concentration which would interfere with swimming or other water contact uses.

The limiting concentrations are those that would make water unsuitable for municipal supply purposes unless expensive and/or nonconventional treatment processes were employed or that would drastically reduce crop yield or that would prohibit or seriously impair the value of water for swimming or other water contact recreation.

Alternative Levels of Maintenance

For planning purposes, the concept of levels of protection for aquatic habitats at other than optimum conditions was found particularly applicable in establishing objectives for dissolved oxygen and criteria for toxicity from both a biological and cost-effectiveness standpoint. This approach, alternative levels of maintenance, is not unique to this study; it has been applied by Warren[4] and by Doudoroff and Shumway in recommending dissolved oxygen requirements for freshwater fish to the Food and Agricultural Organization of the United Nations.[5] Levels of maintenance may vary from pristine conditions to lower levels of protection, the intent being that lower levels of protection do not represent a license to pollute.

Maintenance levels were considered for designation not on the basis of inherent biological sensitivity but rather as influenced by socio-economic considerations such as the cost and time required to upgrade water quality from existing levels, incompatibilities of established and desirable land uses with higher quality levels, or the presence of valued natural characteristics whose well-being is dependent on certain water quality levels.

In this study maintenance level A is a condition where the health and productivity of aquatic life are maintained free from any identifiable risk of impairment by elimination of all waste discharges. This maximum level of protection is considered appropriate for such areas as prime spawning and nursery grounds on which major fisheries are dependent. Maintenance level B is a condition where the productivity of aquatic life is maintained free from significant impairment through water quality management practices. Level B protection is appropriate for aquatic habitats that support important fishery resources such as those occurring in San Francisco Bay. Maintenance level C is a temporary condition where the productivity of aquatic life is somewhat limited due to the effects of waste water discharges associated with major industries or a dense human population, or both, which are not completely controllable. This situation, which presently exists in certain reaches of the Bay system such as the South Bay or affects certain resources such as bivalve shellfish, can only be tolerated on an interim basis.

Use of the alternative levels of maintenance concept in the establishment of water quality objectives allows not only the optimum use of resources committed to water quality control operation but also may be justified on the basis of total resources management. Selected maintenance levels for individual receiving water segments can be revised to reflect changes in social values or changes in the availability of resources required to maintain desired beneficial uses. Moreover, implementation of alternate levels of maintenance allows a rational distribution of limited funds to maximize the improvement in protection of beneficial uses gained through successive stage of implementation of any recommended plan. For example, a higher level of water quality control is recommended to protect a major anadromous fish migration route, the Carquinez Strait-Western Delta region.

Water Quality Planning Criteria

Certain water quality parameters are useful in plan evaluation but are not considered appropriate for recommendation as water quality objectives having legal stature and narrow numerical definition. Parameters in this category are toxicity and algal growth.

Toxicity related to wastewater disposal presents some special problems in view of expressed national goals and the state of technology of toxicity removal, control measurement, and criteria expression. The 1972 amendments to the

Federal Water Pollution Control Act states, that, "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." The new law requires effluent standards for specific toxicants. In December 1973 EPA published proposed limiting concentrations for nine toxic pollutants. The agency is still reviewing this matter; final adoption of toxic pollutant effluent standards is expected late in 1974. These standards will prescribe both concentration and mass emission limits and will vary these limits with type and size of water body.

Toxicity measurements are generally expressed in terms of median tolerance limits (TL_{50}) determined by biossay. The TL_{50} is the concentration at which a substance kills half of the test organisms subjected to the substance for a period of specified duration. Additive effects of toxicants are believed to occur where concentrations are near lethal values; however, in trace amounts the same materials are often nutritional.

Evaluations of the effect of additions of various potential or known toxicants to natural waters have been attempted through study of the health of indigenous biota. Investigators in the United States and England have determined the presence or absence and characteristics of resident fish in natural bodies of water subjected to discharge of waste effluents. The acute toxicity of these effluents was determined by short-term bioassays and information on toxicants present in these wastes; receiving water dilution was established and compared with field evaluations of resident fish populations. Apparent safe dilution levels were established based on resident fish population characteristics.

The planning approach utilized the concept of toxicity emission rates as defined by the product of effluent flow (mgd) and the effluent toxicity in terms of toxic units (tu). Effluent characteristics including toxic emissions from all discharges to the receiving water segment were used to compute receiving water concentrations. The toxicity concentration (Tc) may be computed as

$$Tc = \frac{100}{TL_{50}\ (96\ hr)\%}$$

and expressed in toxic units. Where the effluent fails to exhibit a TL_{50} (i.e., 96-hour survival of test organisms exceeds 50 percent in the effluent) the effluent was assumed to have a Tc of one toxic unit unless there existed a rational basis for further reduction. Reductions were considered for wastes where the type and concentration of the toxicant can be readily identified and measured. The procedure for reduction of assumed effluent toxicity concentration below 1 toxic unit was based on the following three step evaluation procedure:

1. **Evaluation of Water Quality Control Features.** Indications that the discharger could effect a source control and monitoring program relative to toxicants and could construct treatment processes which would remove toxicants expected in that particular wastewater.

2. **Evaluation of Wastewater Characteristics.** Demonstration that the effluent consistently results in a bioassay survival greater than 50 percent (i.e., TL_{50} 100 percent) and that the wastewater components substantiate a Tc value lower than unity based on the following relationships:

Where survival (S) of large numbers of test fish was less than 95 percent in a 96-hour bioassay, the following empirical relationship was assumed to apply;

$$Tc = \frac{\log\ (100-S)}{1.7}$$

Where survival of large numbers of test fish was greater than 95 percent, the above expression was not deemed valid, and the following relationship appeared useful;

$$Tc = \frac{(C_a}{TL_{50_a}} + \frac{C_b}{TL_{50_b}} \ldots + \frac{C_n)}{TL_{50_n}}$$

Where C_a, C_b, and C_n are the concentrations of water quality factors known to exhibit toxic responses in receiving waters such as lead, copper, zinc, cadmium, chromium, mercury, cyanide, ammonia, phenol, MBAS, chlorine and pesticides. TL_{50} values were established for each potential toxicant identified in composite samples of the wastewater effluent. This expression, however, neglects the effects of synergism and threshold detoxification capability of organisms, and can be significantly in error in some cases.

3. **Determination of Dominant Toxicant.** Identification of dominant toxicants based on step 2 above and determination of the nature of these materials in the receiving waters; where degradable materials such as ammonia, phenol, or cyanide are dominant the assignment of reduced Tu was more liberal than for wastewaters exhibiting dominant toxicants having biomagnification properties, such as mercury, cadmium or pesticides.

The maximum allowable toxicity concentrations in receiving waters, expressed as steady state values in tidal waters are specified for alternative levels of maintenance and in three habitat or biotic sensitivity classes. Generally the waters of this region are considered to require a B level of maintenance; however, areas of special biological significance are considered to require an A level of maintenance. As an interim measure some areas may be designated in the planning process as C level. Rocky intertidal areas of the coast, areas of shellfish production and harvesting, and non-tidal waters are generally considered highly sensitive and should be controlled to level B.

The main water mass of estuarine waters is considered of average sensitivity. Ocean waters are considered highly sensitive; however, a value equivalent to a low sensitivity may be permitted in the vicinity of outfall. Special conditions may warrant increases or decreases in sensitivity ranking, for example the presence of harbors and marine shipping terminals may warrant a low sensitivity level within the nearshore area of the port. Proposed toxicity concentration criteria are given in Table 4.2. As indicated, a toxicity concentration of 0.06 to 0.10 is the highest level deemed appropriate for consideration in the receiving waters of the basin.

It is recognized that some of the toxic substances considered in this approach for quantifying receiving water concentrations of potential toxicants will be covered by effluent limitations pursuant to Section 307 of the Federal Water Pollution Control Act. Furthermore, degradable constituents such as ammonia and phenol may be evaluated separately dependent on applicability of dilution zone and effluent pH vs. receiving water pH. Ammonia toxicity is dependent on the concentration of un-ionized ammonia which is influenced by pH. Receiving water should not exceed 0.025 mg/l NH_4OH in the un-ionized form; at pH 8.5 this is equivalent to about 0.3 mg/l ammonia nitrogen at 20 C in fresh waters.

To determine what levels of treatment are necessary to prevent algae from growing to nuisance levels, it is necessary to evaluate the relationship between the consitutents present in water–the physical, chemical and biological characteristics of the receiving waters–and algae. While theories of algal growth potential are widely recognized, it has not been demonstrated that the growth level of algae, as it relates to waste concentrations in the receiving waters, can be accurately predicted.

The traditional approach is generally to determine the limiting nutrient for a given body of water of fixed physical and chemical characteristics and then determine the concentration of that nutrient in the receiving waters which will cause algal concentrations to exceed a given undesirable level. However, this method is not directly applicable to San Francisco Bay due to physical considerations. Light penetration is also an important environmental factor which is growth limiting, particularly in the turbid Bay waters, and must be acknowledged when establishing goals for aesthetically pleasing waters.

What appears more essential is the establishment of the maximum desirable algal density together with a knowledge of the biological response to nutrients in the receiving water. Since the rate of production is largely dependent upon light and chlorophyll *a* content, it appears logical to specify the chlorophyll *a* content for individual receiving water segments within the basin. Waters with deep light penetration and low chlorophyll *a* density are often as productive as turbid waters having a high chlorophyll *a* content. It is reasonable, therefore, to permit a denser chlorophyll *a* content in the more turbid waters of Suisun Bay and the western Delta. Criteria for waters easterly of the Carquinez Straits Bridge reach 50 ug/l chlorophyll *a* as an average summer condition; whereas in the more saline and clearer waters of Central Bay concentrations not to exceed 25 ug/l appear to effect the desired level of protection.

RECOMMENDED WATER QUALITY OBJECTIVES

Water quality objectives recommended here for the protection of beneficial uses were developed from data reviewed during this study and from the literature, including published and unpublished reports. Recommendations from the State and Regional Board staff; the University of California Board of Consultants; the Agricultural Extension Service; and the Departments of Water Resources, Health, and Fish and Game of the State of California were also considerd. It should

Table 4-2. **Water Quality Criteria for Pesticides and Insecticides in Fresh and Salt Water Habitats**[a]

Maintenance level	Sensitivity class		
	High	Average	Low
A	*	*	*
B	0.03	0.04	0.05
C	0.06	0.09	0.10

[a] No discharge permitted to areas designated A.

be emphasized that the word "objective" is used in this section rather than the word "criterion". In a water quality sense, an objective is defined as a formal standard toward which an effort of control is directed; it may not, however, provide optimum protection for all beneficial uses. A criterion on the other hand is more commonly employed when judging the suitability of a water resource for a particular beneficial use. Another reason for the use of the word "ubjective" is to avoid confusion when comparing the recommended objectives with the criteria presented earlier in this chapter.

In general, the recommended objectives are intended to govern the concentration of pollutant constituents in the main water mass. Obviously, the same requirements cannot be applied at or immediately adjacent to submerged effluent discharge structures. Allowable zones of dilution within which higher concentrations will be tolerated will be defined for each discharge at the time discharge permits are drafted. Expression of certain water quality objectives in the form of statistical distribution (50 and 90 percentile values) should also be considered when drafting discharge permits.

In the following section recommended objectives are stated in bold typeface, and are followed in some cases by discussion of the background and rationale of the objective.

Surface Water Quality Objectives for Ocean Waters

This section sets forth water quality objectives for ocean waters to ensure the resonable protection of beneficial uses and the prevention of nuisance. The objectives which follow are quoted directly from the State Ocean Plan. Objectives for temperature are quoted from the State's Thermal Plan.

A. BACTERIOLOGICAL CHARACTERISTICS

1. **Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas[1] outside this zone used for body-contact sports, the following bacteriological objectives shall be maintained throughout the water column:**

   a. **Samples of water from each sampling station shall have a most probable number of coliform organisms less than 1,000 per 100 ml (10 per ml); provided that not more than 20 percnet of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml (10 per ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml (100 per ml).**

   b. **As determined by multiple tube fermentation procedures and based on a minimum of not less than five samples for any 30-day period, the fecal coliform content shall not exceed a log mean most probable number of organisms of 200 per 100 ml nor shall the fecal coliform content of more than 10 percent of the total samples during any 30-day period exceed a most probable number of 400 per 100 ml.**

2. **At all areas[1] where shellfish may be harvested for human consumption, the following bacteriological objectives shall be maintained throughout the water column:**

The median total coliform concentration shall not exceed 70 per 100 ml, and not more than 10 percent of the samples shall exceed 230 per 100 ml.

B. PHYSICAL CHARACTERISTICS

1. **Floating particulates and grease and oil shall not be visible.**

2. **The concentration of grease and oil (hexane extractables) on the water surface shall not exceed 10 mg/m^2 more than 50 percent of the time, nor 20 mg/m^2 more than 10 percent of the time.**[2]

3. **The concentration of floating particulates of waste origin on the water surface shall not exceed 1.0 mg dry weight/m^2 more than 50 percent of the time, nor 1.5 mg dry weight/m^2 more than 10 percent of the time.**[2]

4. **The discharge of waste shall not cause esthetically undesirable discoloration of the ocean surface.**

5. **The transmittance of natural light shall not be significantly[3] reduced at any point outside the initial dilution zone.**[4]

6. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.[5]

C. TEMPERATURE

1. Existing Discharges

   a. Elevated temperature wastes shall comply with limitations necessary to assure protection of the beneficial uses and areas of special biological significance.

2. New Discharges

   a. Elevated temperature wastes shall be discharged to the open ocean away from the shoreline to achieve dispersion through the vertical water column.

   b. Elevated temperature wastes shall be discharged a sufficient distance from areas of special biological significance to assure the maintenance of natural temperature in these areas.

   c. The maximum temperature of thermal waste discharges shall not exceed the natural temperature of receiving waters by more than 20 F.

   d. The discharge of elevated temperature wastes shall not result in increases in the natural water temperature exceeding 4 F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

Alternate water quality objectives may be specified in waste discharge requirements if such objectives would assure full protection of the aquatic environment. Such objectives may be specified in waste discharge requirements only after receipt by the regional board of written concurrence from the State Board and the Environmental Protection Agency.

D. CHEMICAL CHARACTERISTICS

1. The dissolved oxygen concentration[6] shall not at any time be depressed more than 10 percent from that which occurs naturally.

2. The pH[6] shall not be changed at any time more than 0.2 units from that which occurs naturally.

3. The dissolved sulfide concentration of waters in and near sediments shall not be significantly[6] increased above that present under natural conditions.

4. The concentration of substance set forth in Chapter IV, Table B in marine sediments shall not be significantly[3] increased above that present under natural conditions.

5. The concentration of organic materials in marine sediments shall not be increased above that which would degrade[5] marine life.

6. Nutrient materials shall not cause objectionable aquatic growths or degrade[5] indigenous biota.

E. BIOLOGICAL CHARACTERISTICS

1. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.[5]

2. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.

F. TOXICITY CHARACTERISTICS

1. The final toxicity concentration shall not exceed 0.05 toxicity units.[7]

G. RADIOACTIVITY

1. Radioactivity shall not exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California Administrative Code.

Notes for Ocean Water Quality Objectives Section:

1. Body-contact sports areas outside the shoreline zone set forth in Chapter II A.I. and all shellfishing areas shall be determined by the Regional Board on an individual basis.

2. Surface samples shall be collected from stations representative of the area of maximum probable impact.

3. The mean of sampling results for any consecutive 30-day period must be within one (1) standard deviation of the mean determined for natural levels for the same period.

4. Initial Dilution Zone is the volume of water near the point of discharge within which the waste immediately mixes with ocean water due to the momentum of the waste discharge and the difference in density between the waste and the receiving water.

5. Degradation shall be determined by analysis of the effects of waste discharge on species diversity, population density, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species.

6. Compliance with water quality objectives shall be determined from samples collected at stations representative of the area within the waste field where initial dilution is completed. The 10 percent depression of dissolved oxygen may be determined after allowance for effects of induced upwelling.

7. This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

   a. Toxicity Concentration (Tc)

      Expressed in Toxicity Units (tu)

      $$Tc\ (tu) = \frac{100}{96\text{-hr}\ TLm\%}$$

   b. Median Tolerance Limit (TLm%)

      The TLm shall be determined by static or continuous flow bioassay techniques using standard test species. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, the TLm may be determined after the test samples are adjusted to remove the influence of those substances.

      When it is not possible to measure the 96-hr. TLm due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

      $$Tc\ (tu) = \frac{\log 1200 - S)}{1.7}$$

      S = percentage survival in 100% waste.

   c. Toxicity Emission Rate (TER)

      Is the prodcut of the effluent Toxicity Concentration (Tc) and the waste flow rate expressed as mgd.

      TER (tu.mgd) = Tc (tu) x Waste Flow Rate (mgd)

   d. Final Toxicity Concentration

      (FTc) expressed in toxicity units (tu) shall be determined by a bioassay and estimated by the following calculations:

      $$FTc\ (tu) = \frac{\text{Toxicity Emission Rate}}{\text{Initial Dilution Water} + \text{Waste Flow}} = \frac{TER}{Qd + Qw}$$

   e. Initial Dilution Water (Qd)

      Shall be calculated as the product of estimated current velocity, effective diffuser length normal to the prevailing current, and effective mixing depth.

Surface Water Quality Objectives for All Waters Inland from the Golden Gate

This section sets forth water quality objectives for all waters within Basin-2 inland from the Golden Gate. Specific objectives for temperature are quoted directly from the State's Thermal Plan, and the State Board's "Water Quality Control Policy for Enclosed Bays and Estuaries of California" shall apply to all affected waters of the basin.

pH

All waters shall be maintained within the pH range of 6.5-8.5; within this range, waste discharges shall not cause deviation from ambient levels of more than 0.2 pH units in estuarine waters or more than 0.5 pH units in fresh waters.

The above objective encompasses the pH range ususally recommended by the Department of Fish and Game and is consistent with the 0.2 limit of pH change in the California Ocean Plan. A greater maximum deviation is allowed in fresh waters which characteristically exhibit greater pH variation than well-buffered estuarine or marine waters. This increase in pH variation is not considered harmful within the overall limits specified.

Dissolved Oxygen

For all tidal waters, the following objectives shall apply:

In the Bay downstream of Carquinez Bridge	**5.0 mg/l minimum**
Upstream from Carquinez Bridge	**7.0 mg/l minimum**

For nontidal waters, the following objectives shall apply:

Waters designated as cold water habitat	**7.0 mg/l minimum**
Waters designated as warm water habitat	**5.0 mg/l minimum**

Areas of Special Biological Significance shall be maintained at a level of protection consistent with natural undegraded conditions uninfluenced by any controllable water quality factor. Where natural factors cause lower concentrations, controllable water quality factors shall not cause further reduction.

All waters designated as aquatic life habitat shall be maintained at Maintenance Level B, unless otherwise designated. In addition to these limiting numerical objectives, the lower ten percentile dissolved oxygen cencentration value shall be determined as a function of dissolved oxygen content at saturation, in accordance with Figure 4-1.

A review of recent studies of dissolved oxygen concentrations in San Francisco Bay[5,6,7] indicates that the average concentration in portions of the Bay not significantly affected by man's activities approximates 85 percent of the saturation concentration. This value appears relatively constant throughout the Bay system with minor variations, for example, day time concentrations in the area upstream of Carquinez Strait are usually higher than 85 percent due to algal activity. Applying 85 percent of the saturation concentration together with the above requirements for a minimum dissolved oxygen concentration of not less than 5.0 mg/l, results in acceptable concentrations for various levels of maintenance as shown in Figure 4-1. In application, temperature and chloride concentration are determined at the location where the dissolved oxygen sample is obtained. These measurements permit determination of the saturation concentrations from Table 4-3; the lower 10 percentile dissolved oxygen concentration value is then found using Figure 4-1.

The recommended dissolved oxygen objective departs from the Interim Plan statement for fresh waters and enclosed bays in wording but not in philosophy; the above wording is more closely tied to the natural habitat recognizing the resilience inherent in established aquatic life populations and the need for more strict control as natural oxygen values approach minimum values for aquatic life sustenance and propagation. The specific case of the California Ocean Plan is also relevant here, for this plan specifies that dissolved oxygen shall not be depressed more than 10 percent from that which occurs naturally. Thus the concept embodied in the recommended objective is consistent with the ocean plan approach with the exception of the percent deviation which varies with protection levels and ambient DO concentration.

Biostimulation

All waters shall be maintained such that the level of biotic growth does not cause nuisance or adverse effects on any protected beneficial water use as a result of man's activity. Whenever natural factors cause such biotic growths, then controllable factors shall not cause further increase.

The various objectives previously established for biostimulation or nutrient materials are not in conflict with the above statements. Numerical objectives are difficult to determine for biostimulation since the onset of a nuisance takes many forms and varies in different aquatic environment. For example, a chlorophyll *a* value of 5 ug/l would be viewed with considerable alarm in Lake Tahoe where natural values are commonly less than 1 ug/l, on the other extreme, values of 100 ug/l are considered normal in shallow areas of San Francisco Bay where diatoms predominate in the phytoplankton. Because biostimulation effects cannot be rigorously quantified, algal growth is included as a water quality planning criterion earlier in this chapter. The

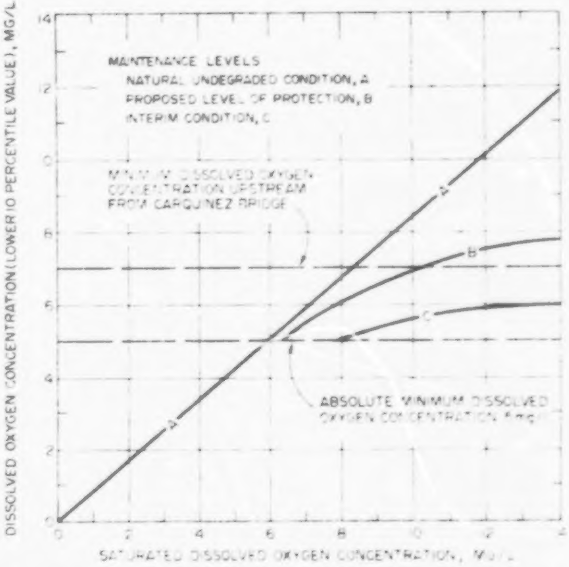

Figure 4-1 Lower Ninety Percentile Dissolved Oxygen Concentrations

Table 6-3. Planning Criteria for Toxicity Control

Temperature, °C	Chloride concentration in water, mg/l					Difference per 100 mg chloride
	0	5,000	10,000	15,000	20,000	
	Dissolved oxygen, mg/l					
0	14.6	13.8	13.0	12.1	11.3	0.017
1	14.2	13.4	12.6	11.8	11.0	0.016
2	13.8	13.1	12.3	11.5	10.8	0.015
3	13.5	12.7	12.0	11.2	10.5	0.015
4	13.1	12.4	11.7	11.0	10.3	0.014
5	12.8	12.1	11.4	10.7	10.0	0.014
6	12.5	11.8	11.1	10.5	9.8	0.014
7	12.2	11.5	10.9	10.2	9.6	0.013
8	11.9	11.2	10.6	10.0	9.4	0.013
9	11.6	11.0	10.4	9.8	9.2	0.012
10	11.3	10.7	10.1	9.6	9.0	0.012
11	11.1	10.5	9.9	9.4	8.8	0.011
12	10.8	10.3	9.7	9.2	8.6	0.011
13	10.6	10.1	9.5	9.0	8.5	0.011
14	10.4	9.9	9.3	8.8	8.3	0.010
15	10.2	9.7	9.1	8.6	8.1	0.010
16	10.0	9.5	9.0	8.5	8.0	0.010
17	9.7	9.3	8.8	8.3	7.8	0.010
18	9.5	9.1	8.6	8.2	7.7	0.009
19	9.4	8.9	8.5	8.0	7.6	0.009
20	9.2	8.7	8.3	7.9	7.4	0.009
21	9.0	8.6	8.1	7.7	7.3	0.009
22	8.8	8.4	8.0	7.6	7.1	0.008
23	8.7	8.3	7.9	7.4	7.0	0.008
24	8.5	8.1	7.7	7.3	6.9	0.008
25	8.4	8.0	7.6	7.2	6.7	0.008
26	8.2	7.8	7.4	7.0	6.6	0.008
27	8.1	7.7	7.3	6.9	6.5	0.008
28	7.9	7.5	7.1	6.8	6.4	0.008
29	7.8	7.4	7.0	6.6	6.3	0.008
30	7.6	7.3	6.9	6.5	6.1	0.008

* Source: American Public Health Association, Standard Methods for the Examination of Water and Wastewater, 13th Edition, 1971.

relationship between nutrient concentration and biostimulation is discussed in Chapter 5.

Turbidity

All waters shall be free from unnatural changes in turbidity or light transmittance where change impairs beneficial use. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas of 1 JTU or more; waters of characteristically low natural turbidity shall be maintained so that discharges do not cause visible, aesthetically undesirable contrast with the natural appearance of the water.

This objective is more restrictive than that contained in the State Ocean Plan which limits the variation from natural levels to one standard deviation. Strict control over controllable water quality factors which may cause a change in natural turbidity is necessary due to the sensitive nature of biota in the receiving waters.

Temperature .E

Cold Waters:

A. Elevated temperature waste discharges into cold interstate waters are prohibited.

Warm Waters:

A. Thermal waste discharge having a maximum temperature greater than 5 F above natural receiving water temperature aryprohibited.

B. Elevated temperature wastes shall not cause the temperature of warm interstate waters to increase by more than 5 F above natural temperature at any time or place.

Enclosed Bays:

A. Existing Discharges

1. Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses.

B. New Discharges

1. Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses. The maximum temperature of waste discharges shall not exceed the natural temperature of the receiving waters by more than 20 F.

2. Thermal waste discharges having a maximum temperature greater than 4 F above the natural temperature of the receiving water are prohibited.

Estuaries:

A. Existing Discharges

1. Elevated temperature waste discharges shall comply with the following:

a. The maximum temperature shall not exceed the natural receiving water temperature by more than 20 F.

b. Elevated temperature waste discharges either individually or combined with other discharges shall not create a zone, defined by water temperatures of more than 1 F above natural receiving water temperature, which exceeds 25 percent of the cross-sectional area of a main river channel at any point.

c. No discharge shall cause a surface water temperature rise greater than 4 F above the natural temperature of the receiving waters at any time.

d. Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

2. Thermal waste discharges shall comply with the provisions of Estuaries, A.1. above and, in addition, the maximum temperature of thermal waste discharges shall not exceed 86 F.

B. New Discharges

1. Elevated temperature waste discharges shall comply with item Estuaries, A.1. above.

2. Thermal waste discharges having a maximum temperature greater than 4 F above the natural temperature of the receiving water are prohibited.

3. **Additional limitations shall be imposed when necessary to assure protection of beneficial uses.**

Sulfide

All waters shall be free from dissolved sulfide concentrations above natural background levels.

Sulfide occurs in Bay muds as a result of bacterial action on organic matter under an anaerobic environment. Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor. Other than its consistency with the State's policy of nondegradation, the importance of this objective as stated is that deviations from natural background conditions will be minimized along with the prevalent odor associated with rotten eggs once characteristic in areas contiguous with San Francisco Bay.

Coliform Bacteria

Water quality objectives for bacterial indicators are listed below:

1. **Waste discharges shall not cause tidal waters to exceed a most probable number (MPN) of coliform organisms of 1,000 per 100 ml; provided that not more than 20 percent of the samples at any sampling station in any 30-day period may exceed 1,000 per 100 ml, and provided further that no single sample shall exceed 10,000 per 100 ml; nor shall the discharge cause the receiving water to exceed a fecal coliform median value of 50 MPN per 100 ml.**

2. **Waste discharges into waters capable of supporting unrestricted shellfish harvesting shall not cause those waters to exceed a median coliform concentration of 70 MPN per 100 ml, nor shall more than 20 percent of the sample exceed 230 MPN per 100 ml. Unrestricted shellfish harvesting areas shall, in every other respect, comply with the requirements of the "National Shellfish Sanitation Program."**

3. **Waste discharges into nontidal waters shall not cause the level of coliform organisms to exceed the limits established below:**

    a. **For nontidal receiving waters used for drinking water supply, the arithmetic average of at least five (5) samples collected over a thirty (30) day interval shall not exceed a total coliform MPN of 100 per 100 ml or a fecal coliform MPN of 20 per 100 ml.**

    b. **For nontidal receiving waters used for water contact recreation (REC-1), the log mean of fecal coliform MPN values shall not exceed 200 MPN per 100 ml; nor shall more than 10 percent of the samples taken exceed a fecal coliform MPN of 400 per 100 ml.**

The above objectives for water contact recreation waters represent a tightening of coliform bacteria standards through application of strict fecal coliform limits in tidal waters as a supplement to previous total coliform limits.

Detrimental Deposits

All waters shall be free of substances attributable to controllable water quality factors that will form detrimental deposits and free from presence of material that can cause or induce formation of combinations or amounts of deposited materials that can be deleterious to beneficial uses of waters and underlying surfaces, with or without resuspension of any deposits.

The wording of this objective differs from that contained in the Interim Plan and the Ocean Plan but is considered to encompass the same level of control and extends beyond the previous statements to cover problems associated with dredging or other activities leading to resuspension of materials which may produce adverse effects.

Floatables

Surface waters shall be free of visible oil, scum, floating debris or other floating substances attributable to controllable water quality factors that produce adverse effects on beneficial uses.

The objective statement for floatable materials is consistent with those in the Ocean Plan and the Interim Plan, it does not attempt to provide numerical limits for floating particulates and hexane extractables.

Color, Odor and Taste

All waters shall be free of substances attributable to water quality factors that produce detrimental, esthetically undesirable color, odor or taste.

This objective is essentially the same as that contained in the statewide policy for the control of water quality, sometimes termed the "Five Freedoms" policy which is contained in Resolution 67-36 of the State Water Quality Control Board. The Interim Basin Plan carries similar wording for odor but is more specific as regards color; the less specific objective is described as this is consistent with the Ocean Plan. Where odor is concerned the objective shall also apply to gaseous emissions from wastewater or wastewater treatment processes where nuisance conditions are produced and exist outside the boundary of the treatment facility.

Fish Flesh Tainting

All waters shall be free of substances attributable to controllable water quality factors in concentrations sufficient to impart unnatural odor or taste to fish flesh or other edible products of aquatic origin.

This objective is consistent with the Ocean Plan and with the "Five Freedoms" policy.

Radioactivity

Radionuclides attributable to controllable water quality factors shall not be present in the waters in concentrations in excess of those given in California Administrative Code, Title 17, or in concentrations which will result in accumulations of radionuclides in aquatic life to an extent which presents a hazard either to aquatic life or their consumers.

This objective is consistent with the Ocean Plan and with the "Five Freedoms" policy.

Toxicity

No substances attributable to controllable water quality factors shall be present in waters in concentrations or combinations which are toxic to, or which produce detrimental physiological responses in human, plants, animal, or indigenous aquatic life, or which create undesirable tastes or odors in organisms utilized for human consumption.

Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration but no less than 96 hours, or other appropriate methods as specified by the Regional Board. The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or other control water which is consistent with the requirements for "experimental water" as described in "Standard Methods for the Examination of Water and Wastewater," latest edition. In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Pesticides

Surface waters shall not contain concentrations of total identifiable chlorinated hydrocarbon pesticides at detectable levels as determined by use of analytical methods prescribed in "Standard Methods for the Examination of Water and Wastewater," latest edition.

Ammonia

The discharge of wastes shall not cause concentrations of un-ionized ammonium hydroxide (NH_4OH) to exceed 0.025 mg/l measured as nitrogen in receiving waters.

For the first time, a water quality objective regarding ammonia is recommended for adoption in the water quality control plan. This objective reflects the national policy as expressed in the 1972 amendments to the federal water pollution control act in that the discharge of waste constituents in toxic amounts are prohibited. Numerical limits for additional toxicants will be considered as sufficient information becomes available to justify their establishment as water quality objectives.

Chemical Quality

No substances attributable to controllable water quality factors shall impair the treatability (require treatment beyond presently accepted practices) of receiving waters used for municipal and domestic supply or waters which are used for irrigation and livestock watering. In waters used for municipal or domestic supply concentrations of chemical constituents shall not exceed mandatory limits as established by the California State Department of Health.

A mean daily chloride concentration of 4,000 mg/l or less shall be maintained in waters east of the westerly end of Chipps Island.

A mean monthly salinity at high tide of 18,000 mg/l TDS or less shall be maintained in the waters surrounding and adjacent to Suisun Marsh.

The quantity and quality of water in the bays and intertidal sloughs of Suisun Marsh shall be sufficient to produce an average salinity of 900 mg/l TDS in the first 12 inches of soil between April 15 and June 1 of each year.

The following chemical quality limits shall be maintained in the surface waters of the Alameda Creek watershed above Niles:

TDS:	250 mg/l 90 day–arithmetic mean
	360 mg/l 90 day–90th percentile
	500 mg/l daily maximum
Chlorides:	60 mg/l 90 day–arithmetic mean
	100 mg/l 90 day–90th percentile
	250 mg/l daily maximum

Whenever natural factors cause the above limits to be exceeded, then, subject to the exception below, controllable water quality factors shall not cause further degradation.

Wastewater discharges that cause the above surface water limits to be exceeded may be allowed if part of an overall water-wastewater resource operational program developed by those agencies affected and approved by the Regional Board. Approval of the program by the Regional Board will be based upon a satisfactory demonstration that the discharge will not impair the beneficial uses of the surface and/or groundwaters.

Groundwater Quality Objective

No controllable water quality factor shall degrade the quality of any usable groundwater resources or adversely affect long-term soil productivity. Where wastewater effluents are returned to land for irrigation uses regulatory controls shall be consistent with Title 17 of the State Health Code and with relevent controls for local irrigation sources.

Although federal law applies to navigable waters and does not regulate groundwater quality, the above objective is consistent with statewide planning strategy which has emphasized control measures for all receving waters both surface and groundwaters.

Nondegradation Objective

The policy enumerated in the State Water Resources Control Board Resolution 68-16, "Statement of Policy With Respect to Maintaining High Quality Waters in California" shall apply to all waters of the state within the basin.